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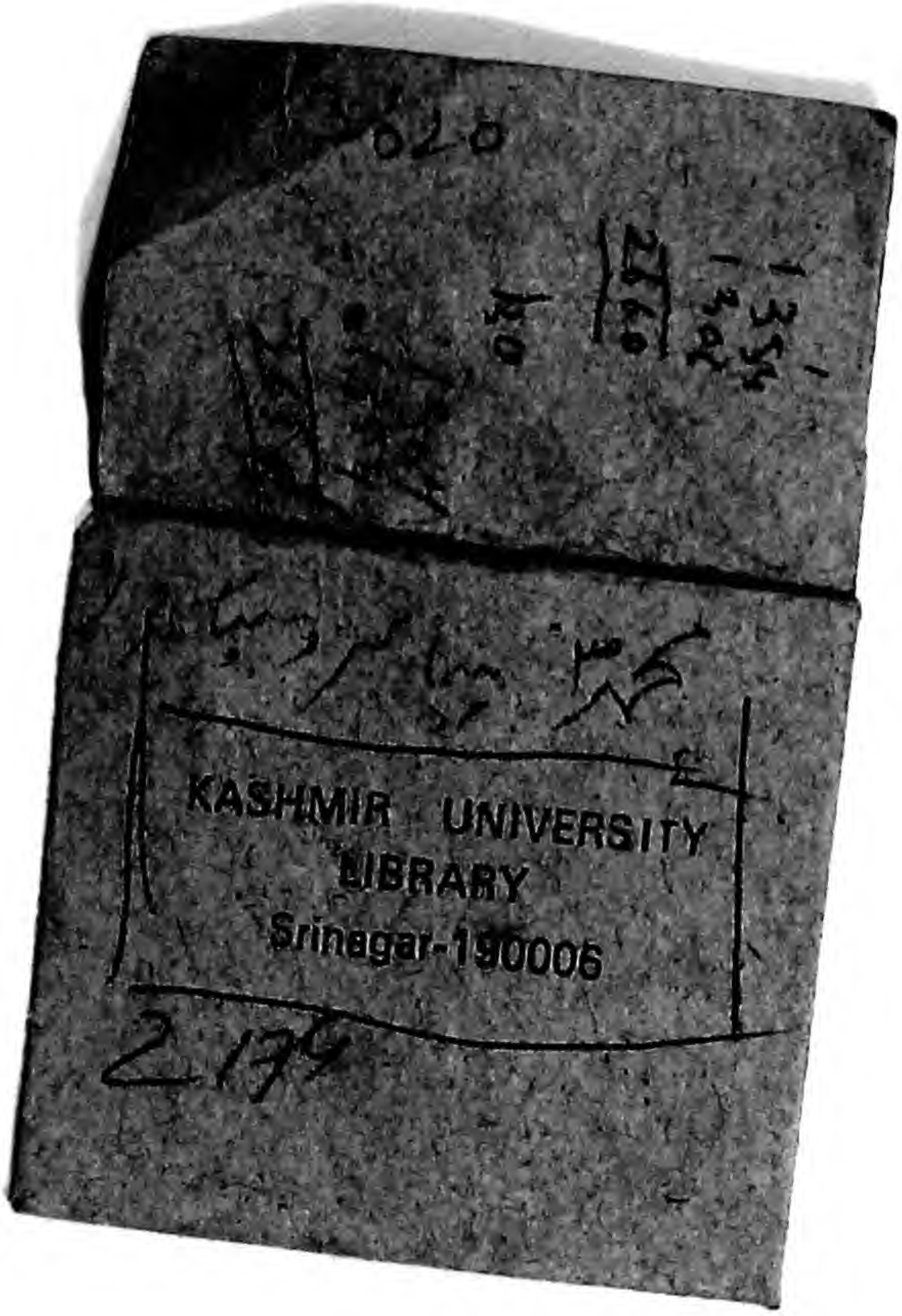

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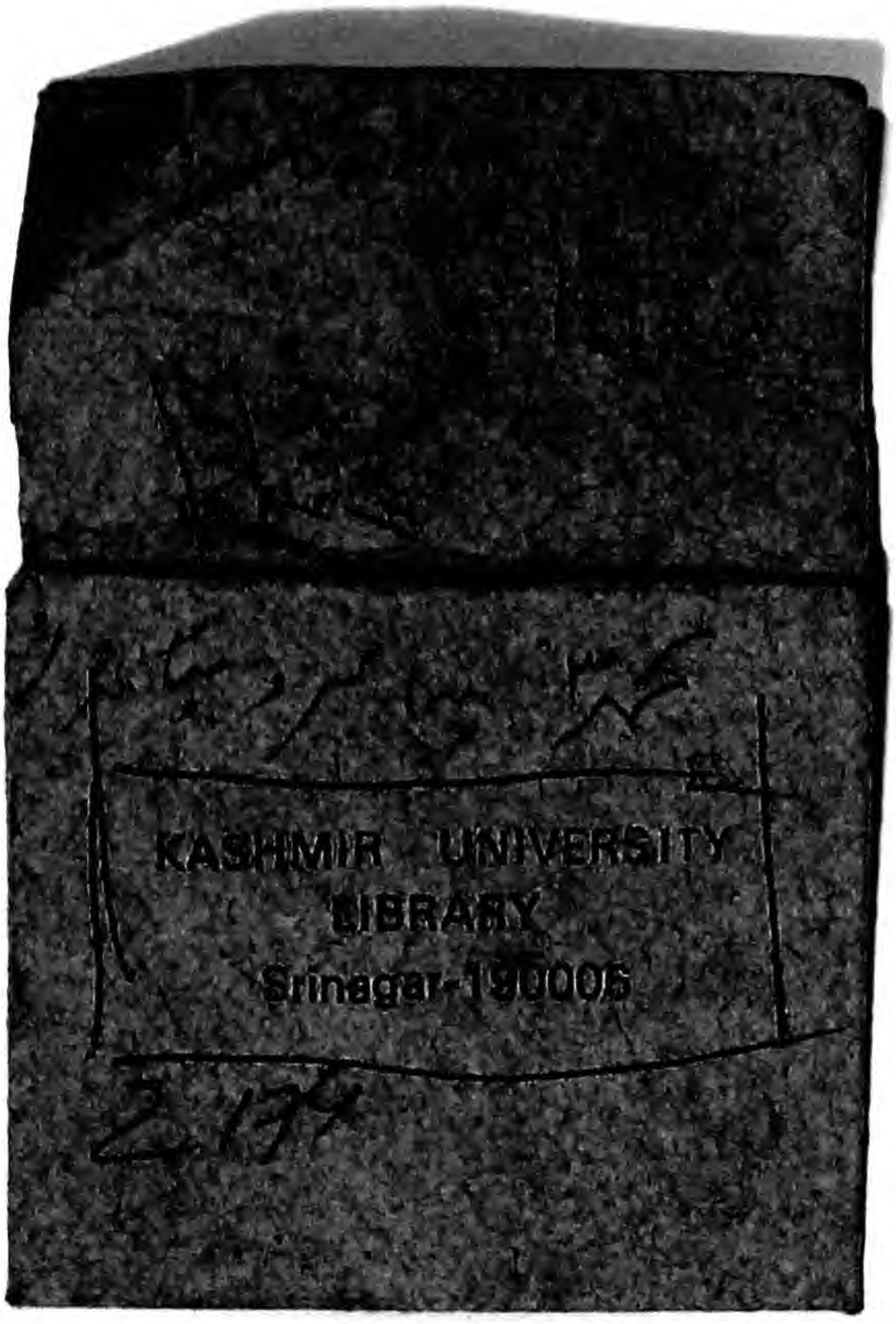
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THE AMERICAN MARITIME INDUSTRIES AND PUBLIC POLICY, 1789-1914

AN ECONOMIC HISTORY

BY

JOHN G. B. HUTCHINS

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HARVARD ECONOMIC STUDIES

VOLUME LXXI

To

MY WIFE

WHOSE CONSTANT HELP AND ENCOURAGEMF
MADE POSSIBLE THE COMPLETION OF THIS W(

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J. G. B. H.

ITHACA, NEW YORK
January 1941

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ABBREVIATIONS FOR REFERENCES CITED

A.R.C.N.	*Annual Report of the U. S. Commissioner of Navigation.*
A.S.P., C.N.	*American State Papers, Commerce and Navigation.*
A.S.P., F.R.	*American State Papers, Foreign Relations.*
A.S.P., N.A.	*American State Papers, Naval Affairs.*
Cal. S.P.A. & W.I.	[British] *Calendar of State Papers, America and West Indies.*
Dingley Report	*Report of the Joint Select Committee on American Shipbuilding* (1882), House Doc. 1827, 47 Cong., 2 Sess.
E.I.H.C.	*Essex Institute Historical Collections,* The Essex Institute, Salem, Mass.
Farquhar Report	*Report of the House Committee on Merchant Marine and Fisheries on the American Merchant Marine in Foreign Trade* (1890), House Rep. 1210, 51 Cong., 1 Sess.
Graham Report	*Letter from the Secretary of the Navy on Ocean Mail Steamships* (1852), House Exec. Doc. 91, 32 Cong., 1 Sess.
Hall Report	Hall, Henry, *Report on the Shipbuilding Industry* (1882), Census Monograph, Tenth Census, VIII.
Historical Statement on Live Oak	Levi P. Woodbury, Sec. of the Navy, *Historical Statement on the Use of Live Oak Timber for the Construction of Vessels of the Navy* (1832), House Doc. 23, 22 Cong., 2 Sess.
Huebner Report	*Report of the House Committee on Merchant Marine and Fisheries, on Steamship Agreements and Affiliations in the American Foreign and Domestic Trade* (1914), House Doc. 805, 63 Cong., 2 Sess.
Kennedy Report	U. S. Maritime Commission, Joseph P. Kennedy, Chairman, *An Economic Survey of the American Merchant Marine* (1937), House Doc. 392, 75 Cong., 2 Sess.
Lynch Report	*Report of the Select Committee on the Causes of the Reduction of American Tonnage* (1870), House Rep. 28, 41 Cong., 2 Sess.

M.B.I.L.S.	State of Maine, *Report of the Bureau of Industrial and Labor Statistics* (annual).
Mer. M. Stat.	U. S. Department of Commerce, *Merchant Marine Statistics* (annual).
Nimmo Report	Nimmo, J., *Report on Foreign Commerce and the Decadence of American Shipping* (1870), House Exec. Doc. 111, 41 Cong., 2 Sess.
R.B.B.T.	*Annual Report of the Boston Board of Trade.*
R.C.N.T.	U. S. Treasury Department, *Report on Commerce, Navigation, and Tonnage* (annual).
R.I.C.	U. S. Treasury Department, *Report on the Internal Commerce of the United States* (annual).
R.M.M.C.	*Report of the Merchant Marine Commission* (1905), Senate Rep. 2755, 58 Cong., 3 Sess.
R.N.Y.C.C.	*Annual Report of the New York Chamber of Commerce.*
Rusk Report	*Report of the Senate Committee on Post Offices and Post Roads on Ocean Mail Steamships* (1852), Senate Rep. 267, 32 Cong., 1 Sess.
Saugstad Report	Saugstad, J. E., *Shipping and Shipbuilding Subsidies* (1932), U. S. Department of Commerce, Trade Promotion Ser. 129.
S.C.C.P.S., 1849	*Report of the* [British] *Select Committee on the Contract Packet Service* (1849), Parl. Papers, 1849, XII.
S.C.C.P.S., 1853	*Report of the* [British] *Committee on Contract Packets* (1853), Parl. Papers, 1852–53, XCV.
Trans. I.N.A.	*Transactions of the Institution of Naval Architects*, London (annual).
Trans. S.N.A. & M.E.	*Transactions of the Society of Naval Architects and Marine Engineers*, New York (annual).
U. S. Treaties (Malloy)	*Treaties, Conventions, International Acts, Protocols, and Agreements of the United States, 1776–1909* (compiled by W. M. Malloy, 1910), Senate Doc. 357, 61 Cong., 2 Sess.

INTRODUCTION

THE PURPOSE of this book is to trace in considerable detail the kaleidoscopic changes which occurred in the organization and economic position of the American shipping and shipbuilding industries between 1789 and 1914, and to discuss the effects and implications of American navigation policies. During this period a group of important changes occurred, which may perhaps be grouped under the heading of the *Maritime Revolution*, and the fundamental features of the modern position of the American maritime industries slowly emerged. A slight amount of attention is given, therefore, to events since 1914, since they are related to the policy and happenings of the nineteenth century. Some attention is also given to the history and policies during the mercantilistic period, during which there were evolved many of the principles of modern nationalistic shipping policy and some of the techniques employed. The main focus of attention, however, is on the vital changes which occurred during the period between 1789 and 1914.

The forces which determined the development of the maritime industries were more complicated than is commonly supposed. Simple statements and analyses are, therefore, likely to be far from the truth. Institutional forms, such as types of organization and commercial relationships; basic cost conditions, such as diminishing timber supplies and economies of large-scale line operations; and technical considerations — all have been important in determining the course of maritime development. The mobility of capital and labor was less than has commonly been supposed, and hence, to some extent, non-competing groups appeared. Often mobility was found to be greater within the maritime industries between countries than from the maritime to the non-maritime industries within the country. The interaction of the navigation policies of the rival maritime nations has also vitally affected the development of the maritime industries. It has, therefore, been necessary to treat foreign policies and the changing economic position of foreign industries, especially the British, at considerable length. This study aims to bring together all of the elements of the problem into an integrated whole.

For the economist there are many important and interesting problems involved in such a study as this. The simple analysis sometimes applied by economists of the Ricardian school is, in general, unsatisfactory. In seeking to find an answer to the questions of why certain changes occurred and what the appropriate policy should have been it is necessary to probe deeper. No complete answer has been given in the following pages, but an attempt to discuss the principal considerations involved has been made. In this connection the work of the new school of theorists dealing with international and interregional trade by means of localization theory, notably Alfred Weber, Ohlin, Hoover, and Dean, has been suggestive. It may well be asked, for instance, what the results of the pursuit of policies designed to improve ocean transportation between a country and other parts of the world are on that country's economic structure. Shipping services, like railroads, are obviously more than economic "commodities"; they have strong localizing and directive effects. Hence, they are matters of considerable public concern. There is evidence that the Ricardian school of theorists, who have had little contact with maritime affairs, have considerably underestimated the influence of transport relations and the geography of the transportation system on the development of national economic strength. Institutional factors have also seriously disturbed the operation of those natural economic forces which determine which industries of a country have a comparative advantage over others, and the extent of that advantage. The problems created by monopoly, rate leadership, conferences, tying freight contracts, unfair competition, the trading advantage of private traders and carriers, the dumping of shipbuilding materials, railroad competition, barriers in the labor market, and many others are all tantalizing and difficult to analyze. Any appraisal of either past or present policy must, however, consider such problems.

The problems created by the rise of large-scale organization in the maritime industries were particularly complex. From a highly-decentralized, small-scale, individualistic type of organization, which provided vast opportunities for the navigating, building, and trading talents of the maritime portion of the population prior to the Civil War, these industries slowly developed a highly organized, rationalized, and concentrated type of organization. The economies of large-scale organization, indeed, became of

major importance, and influenced both the localization and the operation of these industries. Complicated problems regarding the control of these industries consequently arose, but were not solved prior to the World War. Hence much attention has been given to the development of such large-scale organizations, and especially to those supported, more or less permanently, by state subsidy contracts. The transition from the unorganized, competitive system to the administratively-controlled, monopolistic, and organized system thus appears as a major economic change in this work.

The book is organized into three parts. The first contains a general discussion of the interest of the national state in the maritime industries, and the techniques employed in their protection and control. The second part is primarily concerned with the free, competitive maritime economy associated with the wooden sailing ship. The third is centered around the growth of large-scale enterprise, the rise of steam navigation, and the development of new types of government control and protection. The dividing date is taken to be 1862, because in the following year the proportion of American foreign trade carried in American ships for the first time fell below 50 per cent. No great significance need be attached to this particular year, but it is certain that it was during the early 'sixties that the new forces began to influence maritime development significantly. Since in the United States wooden sailing ships played a much larger role than steamships, considerably more than half of the space is devoted to the development of shipping of this type. It is not believed that this emphasis is out of line with the facts. Throughout, an effort has been made to provide a balanced treatment of developments.

PART I

THE MARITIME INDUSTRIES AND PUBLIC REGULATION

CHAPTER I

THE MARITIME INDUSTRIES AND THE STATE

I

SINCE THE BEGINNING of the modern commercial and industrial era in the fifteenth century, no industry has been more affected with a public interest and more continuously subject to regulation than has shipping. Indeed, during this period the industry in the western world has never been free from the stimulating, depressing, or warping influences of governmental regulation. Since shipowners do their business largely in the trade between nations, it follows that the owners of each nation must be affected, actually or potentially, by the controls established by any nation. Thus it is not possible, as is the case in many other fields of public control, to analyze the policies of an individual state without reference to those of others. The strategy born of geography, the striving for sea power, and the struggles of nations to retaliate against or to neutralize the policies of other nations have caused the measures of rival countries to intertwine and distort the development of the maritime industries. The antiquity of many of these policies has caused deep economic grooves to be cut. The result has been that the existing shipping system has been vitally influenced in its development by state action. It is necessary first to analyze briefly the bases of governmental policies.

The regulation of the shipping industry was one of the most prominent features of the power policy of the Mercantilist Age.[1] This was the period when the rising national entities of northwest Europe were struggling to secure unity, power, and overseas empires. In this rivalry, the regulation of the maritime industries played an important part. Those nations which were successful secured control of commerce, monopoly profits, an influence in the development of trade routes, and sea power. Merchant shipping had already assumed its triple role as a source of military strength in war, a means of transportation and communication, and a tool by which monopoly profits and favorable terms of trade

[1] E. F. Heckscher, *Mercantilism*, translation by M. Shapiro, 2 vols. (1935), II, 34.

could be secured and the economies of rival nations adversely influenced. Hence in every state a multiplicity of regulations arose concerning shipping and shipbuilding.

As the mercantilism of the eighteenth century gave way to the free trade of the nineteenth, government control changed in form, but did not greatly abate in influence. Although statesmen were anxious to secure the advantages of cheap sea transportation, and were therefore desirous of abolishing the awkward monopolies of the former period, they did not diminish their solicitude for the prosperity of their respective national industries. Attention merely shifted from manipulating the demand for tonnage and the employment of vessels to manipulating costs. Enormous efforts were expended to improve the competitive position of national maritime industries by encouraging technical advance, by reducing taxes, tariffs, dues, railway charges on materials, and other items of expense, and in some cases by granting subsidies out of state funds.

Toward the close of the nineteenth century the elements of the modern shipping system came into prominence. The struggle to secure competitive advantages made subsidy wars common. In the shipping industry economies of large-scale enterprise caused the formation of great combines; and rings, pools, conferences, and other forms of private monopoly, formerly unknown, became common. Shipbuilding became a heavy industry comprising a few large firms. Governments consequently began to be concerned about discrimination and unfair competition. These aspects increased in importance after the World War when many governments, including that of the United States, became the owners of large fleets of vessels and operators of shipping lines, many of which were used to promote national interests in a most vigorous manner.

With this brief outline of the course of government regulation, we now turn to a more detailed discussion of navigation policies and the objectives of nations in establishing them.

2

To understand the maritime problem, it is necessary to analyze the functions of the shipping industry in modern times. Economic, political, and military considerations are usually combined in any policy, with the result that the appraisal of such a policy from any one standpoint, especially the economic one, is sure to be unsatis-

factory. Because of the complicated nature of the objectives sought by governments through navigation policies, it also follows that the measures taken by each country are likely to be based on the strategic economic and military situations in which it finds itself. Hence there has always been a great variety of policies.

The first, and normally the most important, function of the shipping industry is the provision of transportation for overseas traffic. This has long been recognized as a service which increases the value of goods and personal capabilities by changing their location, and hence is able to command a price. In the case of the United States, a suitable shipping system has been essential for the development of trade with overseas nations and possessions, and, in the absence of a railroad or highway, with South America as well. Therefore, the proper functioning of these services is, and always has been, an important interest of the American government. The shipping system thus is, in effect, an extension of the railroad and highway system to the ports overseas. In the regulation of this system, numerous problems have appeared, among which may be mentioned those of the rate structure, the relation between rates and costs, the layout of the network, foreign discrimination, economic efficiency, quality of service, unfair competition, and the coördination of the various national shipping systems. As in the case of overland transportation, technical change has caused ocean shipping to develop from an industry performing simple functions easily fitted into the system of free, competitive enterprise into one performing complex functions involving the problems associated with overhead costs, imperfect competition, and monopoly. Hence a certain amount of regulation has become necessary to enable this function to be carried out.

A second function is the provision of facilities for internal communication supplementary to the highway and railroad systems. Prior to the railway age, the coastwise shipping activity rivaled that in overseas trade in importance. Thousands of sloops, schooners, brigs, and full-rigged ships, which provided the only cheap means of transportation available, navigated the innumerable waterways of the American seaboard. The development of the railway network in the nineteenth century and of the highway system in the twentieth century caused a relative diminution in the importance of coastwise shipping, which was often considered as an auxiliary agency. The opening of the Panama Canal in

1914, however, greatly increased the significance of coastwise shipping again, and raised new problems regarding the coördination of overland and shipping services.[2] Ships in the intercoastal trade then began to compete for cargoes originating as far from the seaboard as Indiana.[3] The shipping industry has thus played a very significant role in the internal transportation system of the United States.

A third important function of shipping is the carriage of the mails. The value of rapid, frequent, and reliable mail service was early recognized by governments. In the eighteenth and the early part of the nineteenth century, the British government provided, first, royal sailing packets, and later, steamships, expressly for both the imperial and foreign postal services. This policy gave way to that of subsidizing fast steamships in the second quarter of the latter century. The demand for improved communications, indeed, was an important consideration causing the adoption of subsidy systems by almost every maritime nation. Without doubt the public, the government, and business have an important interest in the carriage of the sea mails, which can hardly be measured in terms of postal receipts. Hence there are considerable grounds for the interference which has been designed to improve this service. In recent years, however, subsidy policies have been determined by other considerations as well.

3

Another group of functions is concerned with the national defense. The maritime industries have always been of importance in the economy of national defense, but with the development of totalitarian warfare involving intricate long-range economic planning they have assumed a front rank among the industries affected with a military interest. Hence military and naval considerations have played a growing role in the determination of navigation policies in all of the major world powers.

The value of the maritime industries in time of war has been widely recognized in the United States since the Civil War. The value of shipyards and merchant ships in war was strongly emphasized by the Lynch Committee of 1870.[4] The Farquhar Commit-

[2] H. C. Kidd, *The Regulation of Intercoastal Commerce* (1932), p. 1.
[3] Kidd, p. 28.
[4] *Report of the Select Committee on the Causes of the Reduction of American*

tee of 1890 [5] conceived of the maritime industries as standing apart from others for this reason, and strongly urged vigorous support of them. During the mid-century period the merchant marine was often looked upon as a fighting force, and mail steamships were considered to be suitable vessels for the battle line.[6] Hence the development of the merchant marine was considered by some to be equivalent to the improvement in the strength of the navy. With the rise of American naval power such concepts declined in importance, but the military value of shipping was nevertheless enhanced. This fact was proved during the World War when a great and costly shipbuilding program had to be undertaken for military reasons. The need of providing a suitable merchant fleet for war purposes has since been probably the dominating consideration determining American policy, having been placed first among the objectives of the important Merchant Marine Acts of 1920, 1928, and 1936.[7] Similar considerations have induced many foreign governments to give strong support to their shipping and shipbuilding industries. The maritime industries are thus a very important part of the war economy, and hence policies have never been entirely based on purely peacetime economic considerations.

Merchant ships perform a number of essential functions in war time.[8] First, they are essential in any important military operations requiring ocean transportation both as transports and carriers of military supplies. In the case of large-scale overseas military operations, a very large fleet may be required. It is currently estimated that some 1000 vessels totaling about 6,000,000 gross tons would be required by the United States to service a major force overseas.[9] In every conflict in which the United States has taken part since 1846 shipping services of this type

Tonnage and the Decline of the Navigation Interests (1870), House Report no. 28, 41 Cong., 2 Sess., p. xvi. (Hereafter cited as the Lynch Report.)

[5] *Report on the American Merchant Marine in Foreign Trade* (1890), House Report no. 1210, 51 Cong., 1 Sess., pp. i–ii. (Hereafter cited as the Farquhar Report.)

[6] H. and M. Sprout, *The Rise of American Naval Power* (1939), pp. 133–134.

[7] U. S. Maritime Commission, *An Economic Survey of the American Merchant Marine* (1937), House Doc. no. 392, 75 Cong., 2 Sess., p. 9. (Hereafter cited as the Kennedy Report.)

[8] For a discussion of shipping in the World War see J. A. Salter, *Allied Shipping Control, an Experiment in International Administration* (1921).

[9] Kennedy Report, p. 10.

have been essential. Secondly, the merchant marine must be relied upon to maintain overseas transportation services in time of war in order that essential war products, industrial raw materials, and other cargoes may be imported, and cargoes of export goods may be shipped out to pay for the imports and to relieve certain markets from glut. The more nearly normal the operation of this transportation system, the more efficient the national economy is likely to be. The two requisites for the proper operation of the system are the availability of a sufficient supply of tonnage and the complete or partial command of the sea, or of a part of it, by the navy.[10] The withdrawal of enemy, allied, and neutral tonnage may cause a serious breakdown of the system, since the demand for space is likely to be augmented at the same time. Hence the government has given much attention recently to the development of a considerable supply of American-flag tonnage. Thirdly, merchant shipping may supplement and relieve part of the internal transportation system if the latter becomes overloaded or breaks down. The shipping services are in general more flexible in time of war than railroad services. Fourthly, shipping firms may earn considerable foreign exchange in time of war if given adequate naval protection, especially if freight rates become extremely high.[11] Generally, however, belligerent vessels are at a disadvantage in freight markets. These are the transport functions of merchant vessels during a war.

Merchant shipping may also contribute directly to naval power. First, it may be employed in combat activity. During the period of wooden ships this was a common practice. For instance, the Venetian galleys and round ships, the Portuguese, Dutch, and English East Indiamen, and the Spanish plate ships were all vessels of considerable naval power and frequently saw action. American merchantmen were also extensively armed as privateers during the Revolution and the War of 1812, and were successful commerce raiders. The early British and American mail liners were designed to be convertible into first-class war steamers. With the development of explosive shells and armor plate, however, the usefulness of merchant ships as first or second line war vessels

[10] Captain A. T. Mahan, U. S. N., *The Influence of Sea Power upon History, 1660–1783* (1890), 1917 ed., pp. 26, 87.

[11] During the Civil War Union shipping earned considerable money while operating under the British flag. This was correctly claimed to be an advantage for the economy of the North under the circumstances.

greatly decreased. Consequently American merchant ships were infrequently armed during the Civil War, although the reverse had been true in 1812. Indeed, in the last half of the century war vessels had become so highly specialized that it was extremely uneconomical to build merchant vessels of similar design. Hence the importance of commercial vessels as combat units has decreased, although some are still used as auxiliary cruisers.

In the second place, merchant ships have become of increasing naval value chiefly as supply ships and special-service vessels. A modern battle fleet requires a train of supply vessels, among which tankers are most important, and these today must have a speed of at least 16½ knots if they are to accompany the fleet.[12] Other auxiliaries may be smaller and slower. Large, fast liners have some value as aircraft carriers and auxiliary cruisers, but are vulnerable to armored enemy vessels.[13] Small cargo ships, tugs, and trawlers are useful as anti-submarine vessels, decoy ships,[14] and mine sweepers. It is difficult to overestimate the importance of such fleet auxiliaries in a major naval war.

Ships have become an increasingly important part of the economy of modern war because, like railroads, they are capital goods which cannot quickly be built nor readily purchased. Furthermore, the increase in the importance of overseas transportation systems for every industrial state has made the maintenance of this system of the utmost importance in time of war. Only the adoption of the costly policy of complete autarchy, or self-sufficiency, is a safe alternative. Therefore, many nations, to safeguard their systems, strive to develop merchant fleets and navies for their protection. Hence, so long as war is a possibility, shipping policy is likely to be largely guided by military considerations. Any study of navigation policy covering the last one hundred and fifty years must recognize the fact that broad defense considerations have warped the development of the entire international system.

4

It is also important to recognize that the shipping network may be used as a tool to promote the political and economic interests

[12] Kennedy Report, p. 12.
[13] Kennedy Report, p. 11.
[14] For a discussion of the use of decoy ships see E. K. Chatterton, *Q Ships and Their Story* (1922).

of nations. This may be done by influencing the geographical form and the costs of service of the world's ocean transportation system. Although shipping services do not have the same geographical rigidity as railroad systems, nevertheless they may exert the same powerful influence on the world's localization pattern as railroads. Although transportation is basically a service, and is therefore a commodity in the economic sense, it is nevertheless a commodity of a special type which vitally influences the production of other commodities and services. It has a geographical aspect which is absent in the case of many other types of activity. Transportation is not merely movement; rather it is movement between two or more places, and in the case of railroads and established shipping lines this takes place along clearly defined routes. The location of the route, or, more generally, the geography of the transportation system, is therefore of primary importance.[15]

Under conditions of mobility from the long-run standpoint, production and consumption tend to be localized with reference to basic economic factors, of which the transportation system is one. Hence the question of whether the geography of the transportation system is an active or a passive force is of major significance. If the latter is the case, and railroad and sea communications are developed merely to serve existing centers, the problem of geographical layout is of minor importance. If, however, production, marketing, and consumption centers are frequently governed by transport relations which may be arbitrarily determined within wide limits, then obviously there is a public interest in the development of a suitable network.

It is probable that, in general, transportation systems are both partly determined by existing demand and partly active creators of the geographical pattern of that demand. The positions of localized natural resources, valleys, passes, rivers, and deep harbors, and of existing distributions of population and capital equipment have certainly been factors in the layout of the systems. On the other hand, the history of railroad construction, especially in the American West, is filled with occasions when railroads were built ahead of the traffic, and towns and cities later grew up at strategic positions along the lines because of the transport relations. Junction and transshipment points often grew rapidly

[15] See D. P. Locklin, *The Economics of Transportation* (1938), chap. vi.

because of economies in assembly and marketing, and because the necessity of handling goods made further processing at such points convenient.[16] Thus producing or marketing centers were often created, and these, in turn, attracted other industries, such as banking, public utilities, and retailing. Similar effects have been observed as the result of the development of shipping services.

The problem of the influence of the transportation network on localization is of particular significance in any appraisal of shipping policy. In this connection, distinction must be made between tramp shipping and line services. Tramp ships, which have no fixed routes or schedules, and which usually operate under charter, are the teams and trucks of the sea.[17] They supply on demand transportation service between two ports, and hence can have little influence on location, unless company policy induces the focusing of operations on a particular center. The case of liner services is different, however. Shipping lines have fixed routes and schedules, and usually operate faster ships than tramp owners. They usually secure the more valuable cargoes, many of which are made up predominantly of manufactures. Thus in locating plants, whether on the seaboard or in the interior, many entrepreneurs must take into consideration the routes and services of existing established lines, for individually they usually cannot influence the geographical pattern of these services. The fact that many services have been established as a result of a government subsidy, either foreign or domestic, which usually has been in the form of a contract specifying a particular route, has increased the influence of the shipping industry on the world localization pattern. In this connection it should be observed that the influence of the contract subsidy has been very different from that of the general navigation bounty, which leaves the shipowner free to select the route of his voyage. It is certainly no accident that many subsidies have been of the contract type. Sailing vessels, which were usually tramps, were comparatively passive in their influence on localization, but the development of the powerful metal steamship, which was best operated in liner services and was a much more active localizing force, increased the opportunities for directly influencing the transportation pattern. Therefore the concern of the various

[16] R. G. Hawtrey, *The Economic Problem* (1926), pp. 98–99.
[17] See J. R. Smith, *The Ocean Carrier* (1908), pp. 235–237.

national governments in the operation of the shipping system was augmented.

In the past many nations have taken strong measures to place themselves at a focal point of a network of shipping services radiating to all important world economic areas, in order to improve their transport relations and thus to increase their importance as commercial and manufacturing centers. Indeed, a very considerable proportion of the history of shipping policy is concerned with the efforts of nations actively to develop such networks. Great Britain, in particular, was remarkably successful in developing an extensive shipping network in the last half of the nineteenth century. This system was based on supplies of cheap and excellent ocean steamships and abundant capital, and on the economies of scale and the prestige which her operators secured. At the core of the network were large contract mail carriers, each of which served a major economic region. This network widened the British markets both in buying and selling, doubtless promoted the rise of British industry by increasing the scale of operations, and brought benefits to British firms overseas in the form of increased prestige, business connections, and opportunities for investment. British shipping produced an expansion of economic activity in Great Britain similar to that produced in the heavy industrial centers of the United States and Germany as a result of the completion of the railway networks. Other nations have also endeavored to develop networks of their own. The result has been that a certain amount of conflict in policies has arisen because of the efforts of each nation to mold the development of the world's shipping system in a manner favorable to its own interests.

5

The multiple roles played by the shipping and shipbuilding industries in the economic development of modern states have produced complicated policies and much confusion in policy. This has been especially true of the United States. Three primary objectives may be found to have actuated American policy from the beginning. First, the government has desired the development of adequate ocean transportation facilities on all major sea routes. Secondly, it has striven to secure substantial American participation in such a system. Thirdly, it has endeavored, rather unsuccessfully, to promote the national defense by means of its

navigation policies. On the other hand, there have been limits in expenditure beyond which it could not go. The history of American policy has been the history of efforts to solve the resulting problem.

It is obvious that these objectives, which have also been commonly sought by foreign governments, are not entirely consistent with each other.[18] No analysis of American policy can, in fact, be correct which does not recognize that it has always represented a compromise, the emphasis being laid now on one objective, now on another. Little theory has been employed in determining American policy, and until recently this policy has been highly opportunistic. No fully satisfactory compromise has been or can be achieved between the policies of promoting a rational, low-cost, international system of ocean transportation, and of developing protected national shipping services able to meet American demands in time of war or political tension and to play a leading role in national defense. Hence there have been many inconsistencies. Price-raising navigation monopolies, while protective, have hindered the development of cheap transportation. Autarchist navigation policies — under which all ships had to be built in domestic shipyards, and all domestic trade and much foreign trade had to be carried in national ships — have been incompatible with a rationalization of the national and international ocean transportation systems, although they have promoted national economic and military security. The building of merchant ships designed for service as fleet auxiliaries, transports, or war service in general has caused the ship designs which would be of maximum benefit to commerce to be substantially altered, and the resulting ships have been at times very costly. Even from the standpoint of national defense there has been a conflict between those who have advocated the development of a large low-cost shipping industry and those who have favored investment in a high-cost industry composed of shipping of considerable military value. Vessels of great military and economic value in time of war may, in fact, have little economic justification in time of peace.[19] Hence there has been continual conflict, confusion, and change in American navigation policy, and similar difficulties may be found in those of other governments.

[18] This is recognized by the U. S. Maritime Commission; see Kennedy Report, p. 12.

[19] Kennedy Report, p. 12.

6

It is desirable to consider at length the nature of the marine transportation system required by such a nation as the United States. To do so, however, requires that a clear distinction be made between the primarily economic interests of the country, on one hand, and the military and political interests on the other. In the development of actual policy these interests have been closely entwined. First, however, we shall consider the economic interests alone.

From the standpoint of securing economic efficiency in the marine transportation system, the following are the primary conditions which should be sought. First, shipping services, both in the domestic and international trades, should be provided at the lowest possible charges, thus lowering the costs of goods to consumers, widening the markets of producers, and increasing the efficiency of production by enabling larger economies of scale to be secured. Second, navigation should be developed on all sea routes on which an adequate demand exists. Navigation monopolies and other regulations which distort the geographical course of trade usually increase the costs of shipment, and hence usually prevent the full realization of these objectives. Third, navigation should be promoted by government assistance on those routes on which it appears that a considerable increase in traffic would develop. As in the case of the railroads, the promotion of transportation facilities may yield returns in the long run. Fourth, it is desirable that the price structures of shipping services bear some relation to costs on each route, except where special conditions may make a diversion desirable, and that an international level of costs be maintained so far as possible. Perhaps the outstanding shipping problem, considered from both the political and economic aspects, has been the maintenance of balance in the geographical rate structure. Serious distortions have, in fact, been common. On one hand, protective measures have been employed to raise rates, and, on the other, numerous subsidies have been granted to diminish them. Fifth, it is desirable that competition be fair between national shipowners, and between national and foreign shipowners, and that the distribution of the business among them be on a basis of costs of supply and efficiency. Sixth, it is essential that monopolistic exactions on the part of private

owners, or groups of owners, be controlled. Seventh, shipping services should be suitably regulated in respect to quality of vessels, safety precautions, manning, labor conditions, and character of service. Eighth, in the case of subsidized or state services, proper safeguards to secure efficiency, sound financial conditions, and a reasonable use of the public funds must be set up.

If these conditions could be secured, there would develop an ocean transportation system which would provide adequate service at minimum charges, would be fair in respect to rates between various ports and to those charged individual shippers, and would allow American firms to play a role commensurate with their abilities to provide services at the international price levels. Such a system would be relatively passive in its influence on commerce, for the dominant forces would tend to cause shipping services to become adapted to the needs of trade. Presumably national resources of raw materials, labor, and capital would not be wasted either through an excessive investment in the shipping and shipbuilding industries or through failure to make a sufficient investment. It would be a liberal system in the sense of classical economics, and a rational one from the international standpoint.

The economic history of the last one hundred and fifty years indicates, however, that little effort has been made either in the United States or abroad to secure such a marine transportation system. Indeed, to develop successfully such a system, the major countries of the world would have had to coöperate in order to coördinate their shipping activities and to distribute participation in the system on a rational economic basis. This coöperation has not been secured, with the result that rival policies have frequently clashed, great distortions have occurred in rate structures, and economic resources have been over-invested in some cases and under-invested in others.

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In contrast, the requirements of a nationalistic shipping system, the emphasis of which must be on self-sufficiency and military and naval power, are very different. Less emphasis need be placed on securing adequate service at minimum cost. Instead, nationalistic policies generally aim to extend the national system of internal transportation to seaborne trade. The aims have usually been the security of the state and special economic advantages.

Hence in the past such policies have been highly protectionist. On some routes nations have eliminated all but national vessels, thus securing complete control of the carrying trade. On others they have determined to operate a certain minimum amount of national tonnage. Sometimes they have striven to maintain at least a minimum total amount of national tonnage in service in the general carrying trades, leaving it to the operators to discover the most profitable uses for the ships. The economic and political problems arising out of such a policy have been always complex, but many nationalistic nations have been able by means of various devices to maintain a substantial volume of tonnage in service, and one considerably in excess of that which they would normally have supplied.

In pursuing such policies they have been actuated by certain practical considerations. First of all has arisen the desire to maintain sufficient shipping to enable at least a minimum amount of traffic to be carried on the important sea routes essential to national welfare if foreign shipping should be withdrawn for political or military reasons. Even neutral nations may have their economies seriously disorganized by the sudden withdrawal of a large amount of shipping. Belligerent nations also may suffer from the withdrawal of enemy and neutral tonnage. Thus the desire for security is a primary factor. Indeed, the ability actually to deliver and collect cargoes in foreign ports on occasion may be of great value. This consideration has long been particularly dominant in British policy. Thus, just as national planning has caused the extension of national railroad systems to the frontiers of other countries, so the major powers have endeavored to provide safe lines of sea traffic to foreign ports.

Such a policy of securing the safety of ocean transportation services readily leads to imperialism. It often becomes desirable to secure control of fueling stations, canals, and even overseas terminals.[20] The development of adequate naval and air power to prevent enemy fleets from standing astride the trade routes and blockading ports is also fundamental. Great Britain, for example, developed during the nineteenth century an elaborate system of coaling stations, ports of call, and secure overseas terminals, all of which were defended by a powerful navy, the mobility of which was augmented by the existence of the numerous naval bases and

[20] Mahan, p. 28.

the British merchant marine. Thus the shipping industry, the Royal Navy, and the overseas empire have all contributed to the development of those secure ocean transportation services which are vital to Great Britain.

The United States, the most important transportation system of which is internal, for many years after the close of the early American period paid considerably less attention to the security of its ocean routes. Since the rise of American naval power in the latter part of the nineteenth century, however, and especially since the World War, the problem of security has again come to the fore. This development may be definitely traced to the rise of intense economic and military rivalry among the major powers. The present policy is definitely designed, therefore, to provide an adequate volume of shipping under the United States flag on essential American trade routes regardless of cost. It is, therefore, primarily nationalistic and mercantilistic.

Secondly, a nationalistic shipping policy usually requires the improvement of important national lines of postal communications. This consideration was at first the primary factor causing the British government to establish its important contract services in steam vessels, which now reach all parts of the British Empire and much of the world. Regular and rapid sea communications may greatly facilitate the transaction of both government and commercial business, and the value of such services to the users is usually considerably in excess of the amount of postage collected. They are, indeed, indispensable for the planning operations, administration, and centralizing activities characteristic of nationalistic and mercantilistic states. Inevitably such communications are particularly important to the imperial nations, such as Great Britain, France, Holland, and Italy. The United States has also laid great stress on the development of communications, especially in the Pacific, but the American system, until recently, was not as fully developed as those of Europe.

Third, such a system requires the use of controls over shipping in order actively to influence the course of commerce in ways favorable to national interests. Nearly every maritime nation has in the past endeavored to create such shipping systems as will enable it to dominate commerce to certain portions of the world, and at least to rival its competitors in other portions. For instance, the network of steamship services which British owners,

assisted by their government, established in the nineteenth century, which network stretched out fanwise from the British Isles to North and South America, the Levant, the Far East, and Australia, definitely aided British commerce in these and other regions. Other nations have since endeavored to establish similar systems. Italian shipping now plays an important role on many routes radiating from Italy to North and South America, the East, and the other Mediterranean countries. Japan has likewise made herself a focal point of many transportation routes. The United States made a large-scale effort to do likewise following the World War, and is now in the process of reorganizing and strengthening its system. National rivalries to secure a favorable position at the center of the world's shipping network have thus been a costly but all-pervasive feature of nationalistic policies.

Finally, as has been indicated, nationalistic policies usually must envision the incorporation of the merchant marine and shipyards into the economy in time of conflict. Much emphasis has been placed, therefore, both on the size of the merchant fleets and on shipbuilding capacities. In many cases navigation policies have become closely integrated with defense policies. In connection with shipping there has been much dispute, however, as to what policy is best calculated to improve the national defense. Some have favored the creation of facilities for the rapid expansion of the fleet. Others have emphasized the importance of having a large organized merchant marine in being. During the course of the nineteenth and early twentieth centuries the space of time required to build large, first-class merchant ships increased from a few months to several years. Ships became highly complex capital goods. Hence increased emphasis has been placed in recent years on securing a merchant fleet of adequate size which can be made available for all purposes on the outbreak of war. The experience of the United States, Great Britain, and France in the World War has clearly indicated that under modern conditions large merchant fleets cannot be built rapidly enough to play a vital role in wars lasting but two or three years, especially if shipbuilding operations are hampered by war. In the case of longer struggles, however, such as those of the Napoleonic period, the possession of the facilities, skilled labor, and technicians necessary for extensive shipbuilding have been of great military

value. Hence, to be safe, the major powers have placed strong emphasis on the protection and fostering of both the shipping and shipbuilding industries, but particular attention has been given to the former.

In this connection, the shipbuilding industry is also especially supported in many nations pursuing nationalistic policies, including the United States, because of its value as a means of constructing warships. War vessels are highly complicated pieces of machinery, the construction of which requires not only the use of costly and complex equipment, but also the expert services of experienced and competent designers, draftsmen, constructors, and other specialists, as well as of skilled workers. No nation not possessing such a corps of technicians and workmen has been able to build satisfactory warships rapidly in an emergency. In many nations, and especially in the United States, the naval policy has been to rely extensively on emergency construction for the strengthening of the navy in time of war. The existence of a well-developed shipbuilding industry has accordingly been deemed essential, and hence protective measures have been applied to foster that industry in time of peace when naval orders have been scanty. The United States, for instance, for many years built many of its ships-of-the-line and frigates in the government navy yards, and relied on private builders to supply additional facilities in time of war. Even today, although the facilities of the government navy yards have been greatly expanded, much reliance must be placed on the additional facilities of the private builders.

Such a policy has not proved to be entirely satisfactory, however, because of the difficulty encountered in rapidly expanding the shipbuilding industry under war conditions to meet emergency naval and commercial demands. Indeed, the entire policy of relying on a small-sized, protected, shipbuilding industry for emergency war-time construction has been shown to be a poor substitute for a planned naval-building program designed to maintain the battle fleet at reasonable strength, and for a merchant marine policy designed to maintain in service at least the minimum amount of tonnage necessary to meet essential war needs. In any case, however, some shipbuilding capacity is a prime requisite for national security, even if considerable national naval and merchant tonnage is afloat, because governments normally cannot rely on foreign builders to supply either new war vessels or re-

pairs, and it is often difficult to buy or hire additional, neutral, foreign-flag merchant tonnage during a major conflict. It is important, therefore, to recognize that the shipbuilding industry has been long considered a primary part of the economy of national defense by all maritime nations, and has, for this reason, been especially fostered.

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It is obvious that the pursuit of rival nationalistic shipping policies, while not incompatible with the development of a world-wide shipping system, nevertheless must cause a serious waste of national resources. Such waste has indeed occurred, and must be attributed to the unwillingness of nations to coördinate fully their commercial and transportation policies. Some of this waste has been caused by the inefficiency, instability, and poor management resulting from these policies. The major part, however, has been caused by the desire of the principal powers to build shipping systems suitable for commerce and the development of national interests in time of peace and for security and defense in time of war. Until the dual nature of the objectives of policy disappears, therefore, it is beyond the bounds of possibility to expect a more rational system to arise.

In the case of the shipbuilding industry, nationalistic economic policies have materially increased the costs of transportation. This increase in cost has occurred mainly as a result of the protection accorded to shipbuilders operating inefficiently or situated in uneconomical locations. This protection has been applied either by measures restricting competition and thus raising rates, or by means of subsidies paid out of public funds.

The shipbuilding industry naturally tends to become localized primarily with reference to material supplies because of the influence of transportation rates on costs of construction. Shipbuilding may be strictly defined as the industry of constructing the hulls of ships and launching them. Materials may be partially fabricated, engines and machinery may be built, and outfitting may take place elsewhere, although normally much of this work occurs in the shipyard. The function of the shipyard is, therefore, to assemble these parts and materials and build the vessel. In the age of wooden sailing ships this was essentially a simple craft operation involving the fashioning of the various timbers.

With the coming of the age of metal ships, however, it became a complex task of assembling and erecting many prefabricated pieces, such as iron or steel angles and plates, engines, pumps, generators, and other valuable equipment. In both cases, the industry tended to localize where the costs of building on an extensive scale were lowest, and this was generally close to the sources of supply of the important materials. In this way the costs of transporting such heavy materials were reduced. Ships, once completed, could generally be loaded with a paying cargo, and therefore could be delivered at little or no cost, even at great distances. Hence, nearness to the centers of the shipping industry has been a matter of small economic importance. For instance, the shipbuilders of New Brunswick, Nova Scotia, and Quebec, who built extensively for the British market, had no difficulty in finding outward lumber cargoes. American wooden ships were also often delivered to owners at no expense by loading them with lumber, fish, grain, or other cargoes. Later on, British-built tramp ships were likewise frequently sent out to their owners abroad loaded with coal. Thus in the absence of restrictive regulations the location of the ship market was and is of small importance to shipbuilders.

Access to materials and the sources of partially fabricated goods is, therefore, of great importance because of the expenses of transporting such items. In the period of wooden sailing ships the shipbuilding industry tended to become localized in those countries and regions where ample supplies of ship timber were to be secured close at hand. Such localization tendencies, however, were partially modified by labor cost differentials and by differences in the state of the shipbuilding arts. Nevertheless, there was a strong movement toward the United States, where for many years every material facility existed. This movement was to some extent interrupted, however, by the protective policies of other countries, which forced the shipbuilding industry to remain within their borders. As a result, it was necessary for these countries to import timber at considerable expense or to devise substitutes. Protective measures of this sort, which considerably raised the cost of ship operation in Europe, remained in force in Great Britain until 1849 and in France until 1860 and exerted a depressing effect on the shipping of those nations. On the other hand, with the development of the metal steamship, the shipbuilding industry

tended to become localized in the vicinity of areas of heavy industry, which, in turn, was primarily localized with reference to coal supplies. The concentration of heavy industry and the great economies of large-scale operation tended to concentrate the shipbuilding industry in particular centers. Protection in various countries, including the United States, however, again interfered with the free marketing of ships. But the outlines of the problem were somewhat blurred at this time because of the monopolistic and discriminatory price structures prevailing in the iron and steel and other heavy industries. It is clear, nevertheless, that protectionist navigation policies interfered with the normal development of the world's shipbuilding industry in both periods, and partially diverted it from its normal localization pattern, which was close to its important material supplies.

The problem of free trade in ships is of primary importance. Clearly policies which allow the shipbuilding industry to localize in those areas where material and other conditions are favorable are most advantageous from the standpoint of maintaining the world's sea transportation costs at a minimum. To a large extent the leading nations have refused, however, to follow such policies for the reasons already given. It should be noted, though, that in some cases the result of protection of certain shipyards has been that notable economies of scale have been achieved, and comparatively large national industries have been created. Italy, for example, despite her lack of coal and iron, has become a shipbuilding nation. In the United States, at the present time, where although heavy industry is well developed costs of building are high, a great shipbuilding industry also is being developed by means of heavy naval orders and shipbuilding subsidies, and some substantial economies are being secured. This protectionism, however, clearly has unfortunate effects in most cases. When introduced it usually leads to over-capacity in the world as a whole, with resulting cutthroat competition. Resources in the protecting nations are also likely to be poorly utilized from the standpoint of securing optimum output in peace time. Finally, if the national shipping industries are also protected wherever possible, the costs of transportation are likely to be affected adversely. Hence the restriction of free trade in ships has many disadvantages.

Clearly from the standpoint of the free-trade school of thought protection to shipbuilders is undesirable, unless a case of a true

infant industry can be proved. Many nations, nevertheless, have developed strong protective policies. Those world powers which are wealthy and are anxious to increase the security of their sea transportation systems and to enhance their naval power have protected their shipbuilders to the greatest extent when this has been necessary. This has been particularly true of the United States, Great Britain, France, Italy, and Japan. In the United States a high degree of autarchy has always prevailed, whereas France and Italy have been content to develop the desired amount of shipbuilding chiefly by means of bounties, while maintaining a certain amount of free trade in ships. In contrast, some of the poorer and smaller nations, such as Norway and Denmark, have preferred to buy vessels in the cheapest market. The liberal theories of the Manchester School have therefore had very little effect on the world's shipbuilding industry.

No definitive judgment can be passed on the wisdom of such shipbuilding policies. In the case of the United States the final answer at any time must depend on the degree of insecurity to which American commerce is subjected, on the nature of the total navigation policy, and on the naval program and the type of warship-building policy in effect. In general, however, American protection has been extreme in the past, and has been highly unsuccessful in promoting national defense. Under it comparatively few merchant ships have been built. A sound program for the United States under present conditions would be, first, to devise a planned, stable, long-range schedule of warship construction to be undertaken in public or private yards or both; secondly, to buy the larger portion of the merchant fleet abroad, thus saving expenses; and third, to build such vessels at home as may seem desirable to maintain a shipbuilding industry of such size as is essential for security and defense. This program would have the advantage of maintaining a shipbuilding industry of substantial capacity in all types of work, which capacity would be kept fully utilized, thus reducing the burden of overhead costs, while at the same time the development of the merchant marine would not be hindered by high construction costs.

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In the past, nationalistic policies have also caused the development of shipping enterprise localized in unfavorable centers, and

the distortion of the structure of transportation costs. Most national policies have been designed, as has been indicated, to provide secure transportation systems in ocean trade, whether foreign or coastwise. Governments have striven to secure the development of a national shipping industry of adequate size. It has usually been considered essential that this shipping be registered under the national flag, and frequently it is also required that the officers and crew be wholly or partly nationals, that the ownership be wholly or partly centered within the country, and that the enterprises be subject to regulation in respect to such matters as labor standards, safety devices, employment of vessels, and use of vessels in time of war. Policies of complete laissez-faire in respect to shipping have, indeed, been rare.

In the absence of regulation, shipping enterprise would probably be international so far as the supply of the factors of production is concerned. The ordinary obstacles to the equalization of factor prices between nations, which are usually important in the case of domestic industries, have been less noticeable in the case of shipping. There is, in fact, a strong tendency for the shipping industry to seek the lowest-cost combinations of factors by securing capital where it is cheapest and most abundant, labor from those ports where it is cheapest in relation to its efficiency, and ships from the builders offering the lowest prices. Centers of administration tend to be located in the most strategic ports from the standpoint of securing traffic and managing vessels. In the case of the United States at the present time, for instance, laissez-faire would mean that the industry would use low-priced foreign-built ships and a large proportion of low-wage Asiatic or European labor, but the capital and entrepreneurial talent would probably be of domestic origin and the centers of control would be in United States ports. Strong pressure has, in fact, been exerted by American shipowners at various times to secure economies in this manner, but it has been resisted by the government.

The actual trend of policy, both in the United States and in foreign countries, has been to project national cost levels into the shipping industry. This has been done, first, by means of regulations respecting labor conditions and nationalities of crews. Sailors are normally mobile persons with few attachments, and readily seek the highest rates of pay. Even language difficulties have been of small importance, as is indicated by the high pro-

portion of foreigners who have served on American ships. Seamen are influenced, however, by the prices of consumer goods in the ports where they are paid off. Consequently, the requirement of the United States government that seamen must be signed for a round voyage and paid off in an American port has forced owners to pay foreign crews wages considerably above those paid on competing foreign ships which paid off in their home ports. The imposition of a requirement that all or a portion of the crews be American citizens has still further tended to limit the labor market and to raise costs. For a similar reason, the wage rates on coastwise ships have tended to be above those on vessels sailing to foreign ports because of the smaller proportion of foreign labor which has been employed. Maritime labor policies have, therefore, divided the world's seamen into non-competing groups.

Another type of policy which has destroyed the unity of the market for maritime labor has been the taking of measures to maintain adequate labor standards and efficiency from the national standpoint. Sailors have often been poor judges of their own interests, and shameful exploitation of the crews, especially of deep-sea sailing ships, has occurred on the part of owners, shipmasters, and boardinghouse-keepers. Furthermore, international competition which depresses standards below reasonable levels has readily developed. The control of such practices under some flags, and not under others, has thus led to unfair competition.

An important problem facing many governments, therefore, has been whether or not to raise labor costs by means of protective and regulatory policies. On the basis of the free-trade philosophy important measures would probably not be taken. It might even be argued that it is desirable to secure the most economical crews. Such a view has not been widely accepted, however, because it has become apparent that, if the promotion of national interests and defense plays an important role among the objectives of navigation policy, it is desirable that the ships, like the railroads, be manned by citizens. Furthermore, to secure citizens, it becomes necessary to establish living and working conditions and measures of protection to labor comparable to those prevailing in similar employments ashore. Hence, those nations which because of their economic conditions have secured comparatively high standards of living, usually recognize the desirability of ex-

tending those standards to their ships, even at some public expense, regardless of what wage and labor standards may exist on vessels operating under competing flags. Such action has, indeed, often caused less wealthy and well-situated nations to undertake some similar regulation of labor conditions. The general trend of American policy, as well as that of many foreign nations, has been, therefore, to determine maritime labor policies with reference to domestic labor conditions, rather than to those prevailing on foreign ships.

Second, certain obstacles have been erected to prevent the free movement of capital and centers of shipping administration. Considerable mobility is possible in these respects. Ships are mobile property, and the centers of their control may be established at any foreign or domestic port, or, as was often the case with American trading ships, may be maintained on board the ship. Capital may be secured from both foreign and domestic sources. This has not always been so. During the period of sailing ships, shipping enterprises were predominantly local in their nature, in the sense that the capital was raised, the ships were managed, and the officers and crews were recruited mainly in the home port. The fact that many of these ships were private traders engaged in carrying cargoes for the owners' account also tended to keep enterprises local.[21] Even then, however, mercantile houses located abroad were commonly interested. Nevertheless, vessels were, on the whole, owned and controlled in the countries of their registry. Since the middle of the nineteenth century, however, shipping has become more international in ownership and control. For instance, many American firms invested in English iron sailing ships by taking mortgages and negotiating long-term charters. Others took shares in foreign steamship companies. Today there is a large amount of American-controlled tonnage operating under foreign flags for reasons of economy. Much of it is in the hands of the big industrial carriers, such as the oil and fruit companies. Shipping enterprise has thus become international to a large extent, and would become more so but for restrictions.

The problem of the nationally-controlled foreign-flag ship has become of major importance. Such ships are, of course, subject

[21] For a discussion of such operations see V. D. Harrington, *The New York Merchant on the Eve of the Revolution* (1935).

to the control of foreign governments in peace and war. In time of war, when the country is a belligerent, it is possible that they may be of great value in maintaining services. Such, indeed, was the case during the Civil War, when many American sailing vessels were placed under the British flag.[22] These vessels may, however, be lost to the nation by seizure or requisitioning, or by other means. The foreign nation of registry, if at war, may use them, and they may be destroyed or damaged. Their transfer to the national flag in time of emergency, while formerly possible, has now under the new policies and principles of war become unlikely. The general tendency in policy, both at home and abroad, therefore, has been to discourage the international movement of capital for investment in shipping. Most nations now have stringent requirements that the ownership and control of vessels flying the national flag be clearly within the nation, and discourage investments in foreign-flag ships. It should be noted, however, that these requirements have been partially avoided by means of international holding-company arrangements. There exist, nevertheless, many cramping restrictions hampering the development of international shipping enterprise.

In this respect in the granting of subsidies the requirements are even more stringent. The granting of subsidies to foreign-owned and foreign-controlled shipping flying the national flag has become rare. So also has the granting of subsidies to national-owned and national-controlled shipping flying foreign flags. Under American policy the large fleets of American-controlled vessels flying foreign flags have received no aid. Indeed, discrimination has been shown in awarding subsidies to American-flag ships against those concerns, such as the United Fruit Company, which have tonnage under both the American and foreign flags. National interests, therefore, have caused governments to give their principal attention to the promotion of shipping which is owned, controlled, officered, and manned by citizens; and by so doing, these governments have violated the conditions essential for optimum economy from the international standpoint.

[22] Statement of E. H. Derby, a Boston shipowner, who argued in favor of such action; see Lynch Report, pp. 96–97.

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The result of such measures has been that the localization and organization of the shipping industry have been vitally affected. The shipping industry is basically international in nature, and is most efficiently conducted when factors of production are drawn freely from those regions in which they are most plentiful and lowest in price; provided, however, that adequate precautions against the exploitation of seamen are established. For instance, it may be assumed on the basis of the evidence that during the nineteenth century an international policy of laissez-faire would have allowed capital to be raised primarily in Great Britain, labor to be secured in Europe generally, wooden vessels to be obtained in North America and iron and steel ones in England and Scotland, and centers of administration to be established in the important seaports of Europe and America. The actual results were, however, quite different.

In order to analyze the forces determining the actual localization it is necessary to distinguish the various types of shipping from a functional standpoint. Three types of shipping are to be found; namely, tramp ships, private carriers, and liners. Tramp shipping provides an undifferentiated service of moving cargoes, chiefly raw materials, on all routes on which there is a demand and the seas are free. These ships are normally chartered in open competitive markets for definite voyages, and the supply of tonnage freely adjusts itself to the ever-changing regional and directional shifts in demand. Many American sailing ships of the nineteenth century were tramps of this sort. Private traders are vessels employed by merchants and producers to deliver and collect cargoes, and for general trading purposes. They are normally operated in the export, import, and coastwise traffic of the home ports. During the sailing-ship age, these private traders became extremely common because of the advantages which merchants obtained from the use of their own tonnage. Since the beginning of the modern era, however, private traders or carriers have been operated mainly by large industrial firms. Line shipping is used to provide a common-carrier service over a given route on a predetermined schedule. It thus performs functions similar to those of railroads. Usually a number of vessels are employed, the enterprise develops considerable economies of scale, and offices

are established at the terminals from which cargo is actively and continuously solicited. All of these types of shipping perform valuable services, and a well-balanced marine transportation system, either national or world-wide, should have a proper supply of each type.

One effect of nationalistic policies has been to distort the natural localization pattern of the tramp-shipping industry. An important feature of the tramp-ship business has been its highly competitive nature. The owners have sought profits as bees go after honey. Usually ships have been chartered in a competitive charter market, and hence charter rates have tended, in the long run, to approach the costs of the service. Nationalistic policies have influenced the rates charged on various routes — first, by restricting the market to certain vessels; second, by interfering with the voyage patterns by which tramps reach loading ports; third, by influencing the costs of some of the firms; and fourth, by supporting rate reductions by some sectors of the industry by grants from the public treasury. The result is that the normal localization pattern of the industry has been greatly distorted, and from the international standpoint resources have been wasted. Under a world-wide policy of laissez-faire the business would tend to be international so far as the supply of factors is concerned. Under nationalism, in contrast, each nation tends to contribute to each of the freight markets a supply of tonnage which is determined, first, by the total costs of providing the service with national factors of production, and, second, by the particular freight-rate levels prevailing in each of the freight markets open to it. Navigation laws divide the world into partially non-competing markets for tonnage, and consequently, there is no complete leveling of transportation costs. Navigation monopolies restrict certain routes to certain ships, and, because of the complicated interlinking patterns of ships' voyages, disturb the supply of tonnage on other routes. The size of each nation's tramp-ship fleet is, therefore, determined by the national supply prices of all of the factors of production, and if the total supply price is high, by the protection accorded these vessels on particular routes, or if it is low, by the extent to which these vessels can engage freely in navigation.

The problem of the localization of line-shipping is infinitely more complex. Shipping lines, like railroads, are established on particular routes, from which deviations on a large scale are not

ordinarily made, and large-scale organization necessarily prevails. Such services were first widely established early in the nineteenth century with sailing ships. With the improvements in naval architecture, and the increases in the demand for regular services on the part of manufacturers and merchants, line services increased in importance, became more highly differentiated from tramp services, and — with increases in the fleets of the operators — sailings became more regular. Furthermore, the routes were extended. The early sailing liners had normally voyaged between two terminals, but the steamship services were soon extended to cover many ports of call. Indeed, by the end of the Civil War, the early short lines had begun to give way to trunk-line services on many routes, each of which made connections with feeder services. Also direct connections were made with the sources of traffic by agreements with railroads, and by the establishment of offices from which traffic was solicited. Tramp-ship competition became a leveling factor only in time of slack demand. The result has been that international competition on given routes, instead of being general, has become limited to a few large firms.

Normally such enterprise is developed most successfully at the lowest-cost end of a route. The usual situation, however, is one of international duopoly in which the respective national firms, usually backed by their governments and fortified by national good will in the solicitation of business, divide the traffic, often by formal agreement. Unlike the case of the tramp-ship business, the establishment of services on a given route between two or more countries by firms located in another country, while not impossible, has become difficult because of the diseconomies associated with the conduct of operations at a distance, the obstacles encountered in entering such trades, and legal discriminations. National liner services have tended, therefore, during the last century to become established in such ways as to radiate from each of the major maritime countries to all parts of the world. Competition has become keen between rival lines, or between services in which routes run parallel for some distance, but it has rarely become international over all parts of these routes. Cartels or conferences have usually been established to regulate this competition. It may be concluded that international rivalry in line operations under nationalistic policies is unlikely to lead to an optimum localization pattern of shipping enterprise.

The localization of the ownership of private traders has also been affected. Normally such operators document their tonnage under the flag or flags which will yield the greatest profits. Carriers operating wholly or partly within a navigation monopoly must fly the flag of the nation creating the monopoly. Political and economic considerations govern the localization of the rest. The ships of the great private traders of recent years, the oil, fruit, and steel companies, have flown a variety of flags. The owners of such ships are more free than most to search for that combination of flags which will be most advantageous for their particular purposes.

II

The problems of governments have become extremely complex also as a result of the other changes of the nineteenth century. In particular, the rise of monopolistic elements and conditions of imperfect competition and the development of huge shipping organizations have made an important difference. The bases of judgment regarding the probable waste of economic resources involved in any navigation policy were comparatively simple as long as conditions of reasonably full competition prevailed among enterprises. The theory of free trade is based on the assumption that competitive conditions prevail, for only then can land, labor, capital, and entrepreneurial talent flow in the right proportions into those employments for which each country, considering the relative amounts of such resources as are available, is best adapted. Under such conditions industries can, it is supposed, be readily divided into those for which the nation is comparatively well adapted and those for which it is not. It is usually considered advisable to abandon the latter group unless special reasons for the retention of certain types of business are urged.

The bases of such a judgment were reasonably clear during the period of wooden sailing ships. The conditions essential for perfect competition — namely, many enterprises, small-scale operations, comparatively undifferentiated service, ease of entry and exit, and active markets — prevailed in the shipping and shipbuilding industries to as great an extent as is normally found in practice. In the shipbuilding industry there were hundreds of shipyards, each of which was a handicraft shop, and timber and other supplies were obtained on a competitive basis. Ships were

sold on the basis of prices which appeared in the leading vessel markets. Likewise in shipping the typical firm was small, the total number of such enterprises was large, and, since most sailing ships were tramps or private traders, competition both in the freight market and in the sale of goods was keen. It follows that competition was a reasonably satisfactory regulator of both businesses. The problem of protection was also clear cut. The shipbuilding industry was obviously conducted at a comparative advantage in real cost in the United States, and at a comparative disadvantage in western Europe. On the other hand, the shipping industry, with some exceptions, was conducted at a comparative disadvantage in the United States. Hence the economic issues were clear.

In the period of metal steamships, however, the bases for reaching a judgment became extremely complex. Simple market influences as determinants of success gave way to more intricate forces. Monopolistic influences in the steel industry clearly interfered with the development of the shipbuilding industry. In shipping, so far as line operations were concerned, competition was less and less a satisfactory regulator of the business. As in railroading, it tended to become cutthroat in the absence of controls. Consequently, private agreements, or conferences, were established which exercised strong influences on the development of national shipping industries. The use of such devices to manipulate demand as tying agreements with shippers, temporary ratecutting, and arrangements to interchange traffic with other carriers became common. Another difficulty was caused by the rise of huge concerns which operated vessels on many routes, for their overhead charges did not need to be carried proportionately by the ships allocated to individual routes. Such firms had great power to cut particular rates and levy discriminatory charges. In the case of government-owned or subsidized services, the allocation of the numerous items of expense and of the grants of assistance became impossible. It follows that it became difficult to determine whether or not national shipping operated at a disadvantage, and to establish the amount of the differential, if any.

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As a result of the rise of these monopolistic elements and of government interference the problem of retaliation against for-

eign navigation policies has become of crucial importance. Strong action against policies causing unfair competition by means of discriminating duties or other measures designed to protect the shipping interests of foreign states, and to injure national enterprises which are otherwise in a favorable economic position is clearly justifiable on free trade as well as other grounds. Other measures of unfair competition, such as temporary ratecutting and the use of "fighting ships," which are designed to drive national ships out of business, also require retaliation or control. Often the use of such tactics is approved by foreign governments. The problem of the many subsidies is, however, extremely difficult to handle. Such subsidies are clearly long-term or short-term dumping, in the sense that foreign firms are enabled to provide services to persons living abroad at less than cost. Such services are, therefore, partly gifts. Short-term subsidies, like short-term dumping, should be resisted because of their disorganizing influence on an unsupported national shipping industry. Long-term subsidies, however, come in a different category. Presumably the resulting improvement in communications is desirable. The establishment of a direct subsidized foreign line to the United States need not, in fact, be viewed with serious concern. The development of subsidized services between foreign countries, however, may adversely affect American trade to third countries. It may be desirable, therefore, to counter, not with a line directly competing with that of the subsidizing country, but rather with the establishment of a service to the third country designed to balance the transport relations of that country. There are many other forms of discrimination and unfair competition. All should be examined carefully.

The question of retaliation and counter-development probably hinges primarily on the nature of the national interests in shipping. Such, indeed, has been the case in the United States. Whatever the benefits of using foreign shipping, either because of the natural advantages under which it operates, or because of the subsidies paid by foreign taxpayers, these must be weighed against the costs and dangers of the interruption of service, the possibilities of discrimination or monopolistic extortion, and the high costs and dangers of not possessing an adequate number of vessels in time of war. No definitive answer can be given to this problem. While it is desirable to accept the low-priced services of foreign

shipping to a considerable degree, it is probably unwise to allow such shipping to crowd American shipping completely off the ocean routes, especially if unfair and discriminatory policies are the bases of the foreign success. Hence the problem of the American government is to devise means of securing in an economical manner the development of adequate, but not excessively large, shipping and shipbuilding industries.

13

It remains to examine in the light of this discussion the general trend of American navigation policy during the one hundred and fifty years of its existence. In general it appears that the objectives and methods to be followed have been only gradually formulated. Policies have been slowly adapted to changes in technique and organization. The principles which should guide the formulation of policy have been poorly understood.

During the period in which sailing-ship navigation was dominant, that is, until about the time of the Civil War, American policy was comparatively simple. First, it aimed to improve the ocean transportation system by opening as many trade routes to American ships as possible. Second, strong retaliatory measures were taken against nations which unfairly burdened American shipping with discriminating tariffs or port dues. This policy, which was known as the reciprocity policy, was designed to allow the United States to engage in an industry in which, because of the protection to the shipbuilding industry then prevalent in Europe, it had a definite advantage. Third, in order to secure American control of the important and ubiquitous coastwise traffic it was closed to foreign ships. Fourth, no assistance from the public treasury was given to American shipping in general. Fifth, entire reliance was placed on private shipping, toward which in respect to matters of organization, service, costs, profits, and labor relations a policy closely approaching laissez-faire was followed. Sixth, reliance was placed on the merchant marine to provide privateers, seamen, and gunners in time of war, and on the shipbuilding industry to build warships; no adequate peace-time naval policy was adopted. Seventh, at times it was determined to rival foreign subsidized lines of steamships by means of competing lines, and also by the establishment of subsidized vessels on noncompetitive routes. This was done both because of an unwilling-

ness to allow steam communications to fall into foreign hands and because of the belief that subsidized steamships were convertible into first-class war vessels.

This policy was remarkably successful. At comparatively small additional cost a large, efficient merchant marine was secured, and, except in the building of steam vessels, resources were well employed. The transportation system in both the domestic and foreign carrying trade was economical and efficient, and gave as good and frequent service as the demand warranted. Competition proved to be a reasonably satisfactory regulator of the system. The protective measures were not burdensome except in the case of the California gold rush, when tonnage became unnecessarily scarce, and in the building of steamships, for which the country was ill-equipped. The size of the merchant marine was ample for purposes of war. Only the extreme weakness of the navy jeopardized overseas traffic, as was shown by experience in the Napoleonic and Civil Wars. It must be recognized, however, that the economic situation in the country was such that the natural development of the maritime industries provided adequate national security, and excessive interference by the government was unnecessary.

Since the Civil War, the policy of the government has been unsuccessful. The former policy then became of questionable value. In general, until the World War, the tendency was to accept in most branches of the foreign trade, low-cost, foreign shipping services and the benefits of foreign bounties. Only sporadic and ill-conceived attempts were made to counter foreign subsidies. The coastwise trade, however, including that to the island possessions was fully protected. It is even probable that American participation in the foreign carrying trade was less than might have been expected considering the capital resources and other advantages of the country. This difficulty arose from the following causes: first, the price structure in the steel industry; second, the protection accorded the high-price shipbuilding industry; third, the failure of the government to retaliate against foreign subsidies and discriminatory policies; and fourth, the inability of the struggling shipping industry to reach sufficient size to enable it to secure economies of scale, extensive good will, and economic power. Of major importance in American policy was the desire to protect the shipbuilding industry in order to secure surplus capacity for

the building of warships in time of war. This policy, which attempted to combine free-trade philosophy with certain measures designed to promote national security, was ill-conceived, and resulted in a failure to develop the sound merchant-marine policy necessary for the national security. It led to a costly and wasteful use of resources, and to the near-breakdown of the ocean transportation system during the war, with the resulting expenditure of huge sums of money to create a merchant marine.

Since the World War, efforts have been made to hammer out a policy which will more nearly meet the needs of the United States. This policy has recognized that the conditions of operation in international line services, which now dominate ocean traffic, are such that laissez-faire is unlikely to produce an economical equilibrium. A nationalistic, transportation system has been developed, providing American-flag services on the trunk routes of United States commerce.[23] Policies have been designed to prevent the debacle of 1914–18, with its injury to American commerce, by maintaining a minimum amount of tonnage in service. More careful attention has been given to the techniques of policy in order that it may be carried out with efficiency and at minimum cost. The shipping and shipbuilding industries have been brought under rigid regulation with respect to service, vessels, operations, profits, expenses, and investment. The policy of laissez-faire has been abandoned, and the American maritime industries have, in fact, become new public utilities subject to the control of the Maritime Commission. Finally, government ownership and operation have been widely adopted, when necessary, to develop the American shipping industry.

It becomes apparent, therefore, that shipping in modern times has developed such large-scale economies of operation, and that such imperfections in competition have arisen, that free-trade theory and policy have become of doubtful value. Considerations of national security have also played an increasing role in determining policy. Emphasis has been laid on developing an American overseas transportation system. For this purpose new and elaborate techniques have been devised to secure the effective functioning of this system. The latest developments, however, lie outside the scope of this work.

[23] P. M. Zeiss, *American Shipping Policy* (1938), pp. 115–185.

CHAPTER II

THE TECHNIQUES EMPLOYED IN REGULATING AND PROTECTING THE MARITIME INDUSTRIES

I

WE NOW TURN to the consideration of the techniques employed in the protection and regulation of the maritime industries. These techniques were rapidly developed during the last century and a half in all of the maritime nations. Naturally each nation has endeavored to adapt its techniques to its objectives, its geographical position, its financial resources, and its shipping conditions.

In general, policies have become much more complex. In the mercantilist period, in which national interest was pursued with great vigor, simple protective measures of a type tending to promote an extreme kind of self-sufficiency in shipping and shipbuilding were employed in England and France. The domination of ocean communications, the achievement of security, and the promotion of naval power were the primary objectives. Within this protective system a policy of laissez-faire was widely followed, competition being the chief regulating force. In the modern period, however, techniques have become more complex because of the expansion of world commerce, the increased importance of ocean communications, the improvements in the art and science of shipbuilding, and the rise of large-scale organization. The public interest in the functioning of the maritime industries has been greatly increased. Therefore, new techniques have been evolved, designed to secure the proper functioning of these industries from modern nationalistic standpoints. Perhaps the outstanding development has been the use of subsidies in place of navigation monopolies and discriminations. In regard to the internal structure of the industries, measures have been adopted designed to control the operation of vessels, investment of capital, profits, rate agreements, and similar details, and hence the former policy of laissez-faire has been superseded. An examination of the various techniques pursued by governments is, therefore, of great interest.

Navigation laws may be defined as those measures which are specifically designed to stimulate, protect, or regulate the industries of shipping and shipbuilding. The most important part of this legislation in each country has been protective, and has been established to enable the national shipping industries to survive, at least in some carrying trades, under conditions of keen international competition. A second part has been designed to promote transportation and communication in order to secure benefits therefrom. Such, for instance, have been the comparatively rare cases of subsidies given to foreign shipping companies, such as that granted by Brazil to an American line after the Civil War,[1] or, more recently, that given to an Italian line by the South African government. Finally, a third and increasingly important part deals with the regulation of the shipping and shipbuilding industries in order to safeguard the public interest.

Navigation laws may be divided into primary and secondary measures. Among the former may be listed such important measures as the granting of subsidies, the closing of the coastwise trade to foreign ships, and the regulation of shipping enterprises. There are, however, many secondary measures, such as tariff drawbacks, favorable railroad rates on shipbuilding materials, laws for the control of labor relations, minimum wage laws, special credit measures, and the like, which are of somewhat less importance and may not be related directly to the objectives of navigation policy in general. Nevertheless, these measures all contribute to the final outcome. Indeed, in such complex industries a host of policies determine the final equilibrium.

It has been estimated that there are over a hundred different techniques of protection and control which are or have been used by maritime nations. It is rare that any of these measures are undertaken independently of others, and the policy of any country is certain, therefore, to be one of the many possible combinations of policies. Hence the policies of various countries have rarely been exactly alike. That of any particular nation has, in general, depended first on the objectives of the government; second, on the economic condition of its maritime industries; third, on the geographical structure of its ocean traffic system; fourth, on the ability of its rivals to retaliate; fifth, on its financial and other

[1] J. E. Saugstad, *Report on Shipping and Shipbuilding Subsidies*, U. S. Department of Commerce (1932), pp. 57–58. (Hereafter cited as the Saugstad Report.)

resources; and sixth, on its economic organization and general internal business policy. In the case of the protectionism of the United States, the needs of national defense, the large volume of domestic coastwise traffic, the strategic geographical position of the country, and the traditional reliance placed on private enterprise and on competition in economic policy have been considerations of dominating importance. Other nations likewise have endeavored to adapt their policies to their own institutions, economic and geographical positions, and objectives. Let us briefly review the more important measures.

Among the primary measures employed there are five principal categories. First, there are navigation monopolies, which are designed to protect national shipping by entirely eliminating foreign vessels from the carriage of goods and persons on certain routes. In a weaker form this policy takes the shape of navigation discriminations which handicap such shipping by means of discriminating port dues, duties, or other burdens. An expansion of the national industry is secured because of the resulting higher freight rates and passenger fares on the protected routes and of the increased business available for national operators. Second, subsidies and bounties to shipowners are employed to force foreign shipping organizations to reduce their operations on particular routes, or to restrict their activity and investment in international services generally. Such measures are also frequently used to expand the capacity of the national merchant marine, regardless of whether or not others are forced to contract in size. As a result of these policies consumers and shippers generally secure lower freight rates, and the expense is borne by the national treasury, and ultimately by the taxpayers. Third, there are the registry laws, which determine the sources from which national enterprises can secure ships, and which ordinarily place some restrictions on the purchase of foreign-built ships. These are of the utmost importance because of their influence on the cost of conducting national shipping services. The restrictions commonly embodied in subsidy measures regarding the origin of subsidized vessels have the same effect, and therefore lie in the same category. Fourth, there are subsidies and other aids to shipbuilders, which may be quite distinct in purpose from those granted to the shipping industry. These measures usually reduce the cost of ships to some or all domestic owners and perhaps to

foreign buyers as well. Sometimes, however, blanket subsidies are given to shipowners to cover differentials in both the cost of building and the cost of operating. Fifth, there are the measures which govern the geographical pattern of the system in general, and more particularly the layout of the trunk services, and which regulate the conduct of operations in their major aspects by prohibiting, forming, or controlling monopolies, establishing rules of unfair competition, checking undue geographical and personal discrimination, and, at times, controlling profits, investment, reserves, and forms of organization. These controls become particularly important in the case of subsidized shipping.

In addition there are many measures in the category of secondary laws and policies. Shipbuilding costs may be influenced by the height of the tariff, the existence of drawbacks, the establishment of bounties on steam and Diesel engines and other ship machinery, the volume, stability, and profit rates of naval construction programs, the level of railway rates on shipbuilding materials, the requirements as to speed and safety, and labor policies. The costs of ship operation may be affected by government controls over manning scales, seamen's wages, labor relations, the citizenship of officers and men, the hiring and paying-off of crews, and discipline, by regulations respecting repair work and by tax laws. In the financial field the widespread establishment of construction loan funds, the giving of government guarantees of private loans carrying low interest rates to shipowners, and the prices and conditions established for the sale of government-owned tonnage are also important.

Finally, demand conditions in the shipping industry may be affected by policies regarding railroad affiliations or agreements, the movement of officials and government material, and the conduct of foreign trade in general. Many, in fact, are the policies which exert an appreciable influence on the maritime industries.

It should be emphasized that the geographical elements of the problem play an important role in determining the kinds of policies employed by various nations. From the geographical standpoint shipping services fall into five distinct groups. First, there are the services which are coastal and compete with domestic overland carriers. The extensive American short- and long-voyage coastwise traffic, and the important carrying trades between the Atlantic and Pacific coasts fall into this category. In the case of these

shipping operations, the competition of overland agencies must be considered. The coördination of the shipping and inland transportation systems, therefore, becomes of the utmost importance, but this coördination may be readily secured because the entire system is under the control of the national government. Second, there is the international coastwise carrying trade in which there is competition from rival overland services. For instance, such traffic is particularly important in Europe and South America. In this case no one country can organize the system. Third, there is the imperial or overseas "coastwise" carrying trade in which overland agencies cannot compete, and which may be regulated by one nation. Typical of this type of business are the American carrying trade to Hawaii and the French carrying trade to the French North African possessions. Much of the internal trade of the British Empire is of this type. Such services may be considered as adjuncts of the domestic transportation system and may be fully protected. Fourth, there is the foreign carrying trade to important rival maritime states. Such, for instance, is that between the United States and Great Britain. The nations at the ends of such routes exert the greatest influence on the conduct of such trades. Ordinarily, monopolization or the use of unfair or protective practices by one power quickly bring retaliation and must be abandoned or operations become impossible. Fifth, there is the foreign carrying trade to non-maritime nations. The significant feature of this business is that protective measures may be more readily applied without provoking effective retaliation. For each nation the total amount of national tonnage in service depends on the extent of the traffic available to it in each of these divisions and on the policy pursued in each case. The geography of the problem is therefore very important.

2

Let us first examine the navigation monopoly, and the milder but similar device of discrimination by means of duties and port dues. These are probably the oldest techniques. Such monopolistic restrictions may be applied to one-way or two-way traffic on certain routes. For instance, the British navigation laws prohibited the importation of goods from certain ports in foreign ships, but did not prevent exports. They may merely prohibit the transaction of business, as has the American law, or they may

actually forbid the navigation of vessels in certain waters. Although these monopolies have been most frequently applied to the domestic, coastwise, and imperial carrying trades, nevertheless, they have also been used in the foreign carrying trades as well.

The use of this technique has led to the establishment of widespread systems of protection in the past. The most important in the history of the seventeenth, eighteenth, and early nineteenth centuries was the extensive and famous British navigation system. The United States likewise created an important system by closing its extensive coasting trade to foreign ships by means of heavy dues in 1789,[2] and by outright prohibition in 1817.[3] Furthermore, in 1817 the American system was extended by means of certain limitations on the employment of foreign ships in certain branches of the foreign carrying trade; but these were later abolished. Since then the monopoly of the coastwise trade has been extended to the trade with many American possessions overseas, notably Alaska, Hawaii, and Porto Rico, and to the intercoastal traffic. Coastwise and imperial monopolies in some form were at the beginning of the last decade part of the systems of France, Germany, Italy, Spain, Japan, Australia, Brazil, Canada, Chile, and other states.[4] Navigation monopolies have, therefore, been common tools used to protect shipping.

The usual objective in establishing a navigation monopoly is to protect national shipping enterprises by forcing out of the carrying trade the ships of foreign nations. The result is that freight rates rise and the national shipping industry expands until the supply of tonnage is sufficient to meet the demand at rate levels which yield normal profits in the long run. If competition between national shipowners is perfect, or nearly so, the rates in such trades may be expected to oscillate about the cost of service. This was the case when the American monopoly was established in the coastwise trade early in the nineteenth century. A navigation monopoly, therefore, is equivalent to a prohibitive tariff applied to a competitive industry. If the domestic costs of service are below those of foreign nations, the navigation monopoly, of course, is of no protective value. If the reverse is true,

[2] 1 U.S. Stat. 27.
[3] 3 U.S. Stat. 351.
[4] Saugstad Report, pp. 167–168, 189–190, 314, 411, 450, 470, 483, 554.

however, freight charges will rise until the costs of the domestic industry are covered, unless other forces intervene. The cost of protection is, therefore, paid by the shippers, and is usually passed on by them to others. If, however, a monopolistic situation prevails, such as when one line dominates a branch of the coastwise carrying trade, or a ring is formed, rates may rise even higher than is desirable as a result of this fact. It may be seen, therefore, that protection of this nature becomes a very complex problem if competition is displaced by large-scale monopolistic enterprise dominating the coastwise trade.

The effect of a navigation monopoly depends on several conditions. Most important is the elasticity of the demand for tonnage on the protected route. Ordinarily this will be high if freight charges are important in relation to the selling prices of goods, if alternative routes are available, or if the industries concerned are mobile. In case the elasticity of demand is high, a serious shrinkage in traffic may occur and the resulting expansion of the national shipping industry will be slight. If, on the other hand, the demand for shipping services is inelastic, the volume of tonnage employed will not be seriously diminished and the trade may be an important preserve of the national merchant marine. This has been true, for example, of the lucrative carrying trade from the United States to Hawaii, in which a large amount of American-flag tonnage is employed. The demand for tonnage in the coastwise coal, lumber, and other bulk-cargo trades also tends to be inelastic. The effect of a monopoly will not be the same, therefore, in all branches of the coastwise trade.

Clearly the demand will be most elastic where competition from other routes and agencies exists. This is particularly true in the case of railroad competition. The comparative levels of rates of rail and water carriers determines the extent to which railroads will act as feeders of shipping services and the extent to which they will be competitors. Railroad rate structures usually provide, however, that rates may be lowered on those hauls on which competition from water carriers is encountered. Such procedure has been sanctioned by the Interstate Commerce Commission and the courts.[5] It follows, therefore, that the effect of a coastwise navigation monopoly depends to a large extent on the policy pursued in respect to railroad rates. The development of the railway sys-

[5] Locklin, pp. 559–562.

tem in the United States greatly reduced the protective value of the American policy of monopolizing coastwise shipping during the latter part of the nineteenth century. The building of concrete highways and the development of motor carriers during recent decades have still further eliminated coastwise shipping from its former important preserve, the short-voyage coastwise traffic, in which it was ubiquitous in the sailing-vessel period. Even in the long-voyage coastwise and intercoastal trades the competition of overland agencies has been felt. The development of the internal transportation system during the last century has, therefore, increased this elasticity of the demand for coastwise tonnage to a high degree. Hence the navigation monopoly has checked seriously the expansion of the coastwise shipping industry. A reduction in the costs of ship operation in this trade is, therefore, of the utmost importance, if the coastwise shipping industry is to develop further.

The elasticity of demand also is likely to be high if it is possible to avoid the high rates usually resulting from a navigation monopoly by rerouting cargoes, if industry can be relocalized, or if the traffic cannot bear the cost. In the case of many trades, it is possible to reroute cargoes by way of third countries, where they may be warehoused, or may even be partially or wholly fabricated. For instance, the British, in establishing their navigation system in the seventeenth century, found that cargoes from the Far East and America could be carried cheaply in Dutch bottoms to Dutch ports, and thence reëxported in one form or another to England. Stringent measures were taken, therefore, to prevent the entry of goods by this route. Cases in which the traffic cannot bear the cost are also common. This occurs where one producing center is marginal with respect to certain markets. For instance, the failure of the United States to extend its monopoly to the Philippine Islands was originally due to the fear that it would injure the ability of the sugar industry there to compete with that of Cuba and Puerto Rico. It is obvious that the imposition of monopolies which substantially raise the costs of transportation will have unfavorable repercussions of considerable importance on industry, agriculture, and markets. For this reason the navigation monopoly is not today the most popular protective device.

Much also depends on the conditions of supply of national shipping services. If the costs are considerably in excess of those pre-

vailing abroad, and if no economies of large-scale operations result, the rise in transportation costs may be considerable. If a monopoly is imposed in order to protect a high-cost domestic shipbuilding industry, as is often the case, this is likely to be the result. Such, indeed, has been the result in the United States since the Civil War. If, however, the differential in total costs, including those of building ships, is small or non-existent, and if economies of scale develop in both shipping and shipbuilding, then transportation rates may not rise as the result of the elimination of foreign tonnage unless a private monopoly arises, and they may even fall. It should be noted, however, that the sudden imposition of a navigation monopoly may cause a sharp, short-term rise in rates because of the resulting temporary shortage of tonnage. Likewise, difficulties may develop if sharp booms arise in the protected trades. For instance, the sudden appearance of an unprecedented demand for tonnage for the California trade in the early 'fifties caused rates to rise to fabulous heights because of a shortage of tonnage, although the shipyards were operating at full capacity building clipper ships.[6] Thus the influence of a navigation monopoly on transportation costs also depends on the conditions of supply to a large extent.

3

For purposes of analysis, navigation monopolies may be divided into four groups based on differing combinations of geographical, economic, and political conditions. First, there are the monopolies of the domestic coastwise trade. Such monopolies are most widespread and important. In the case of the United States the protected coastwise trade has been the principal employment for merchant ships since the Civil War. In scope this monopoly is the largest to be established since the British navigation system, and the traffic actually or potentially available is of magnificent proportions. The existence of this protected field of operations for the marine has made the development of a more extensive foreign-trade fleet less pressing, considered from the military standpoint, in the past. Such monopolies are distinguished by the fact that the government can exercise sole control over the traffic. Retaliation by foreign nations is difficult, except by shutting the shipping of the protecting nation out of similar carrying trades abroad. If

[6] A. H. Clark, *The Clipper Ship Era* (1910), pp. 100–106.

this shipping activity is of small extent, however, the counter measures will be of small importance. For instance, little American shipping has been employed in the coastwise carrying trades of other countries since the Civil War, and hence the American navigation monopoly, despite its scope and importance, has remained practically unchallenged.

It should also be noted that such navigation monopolies protect shipping engaged in the foreign carrying trades as well, by providing protection on important parts of multi-angular voyages. For instance, the American fleet engaged in the triangular cotton trade in the nineteenth century obtained an advantage because of the protection accorded on the leg from North Atlantic to southern ports. Since the World War the American liners engaged in the round-the-world service have also been able to secure protection in the carriage of cargoes from Boston and New York to California and Hawaii. Foreign shipping consequently has been forced to find an alternative route by way of South Africa and South America. Coastwise monopolies, therefore, not only protect shipping on domestic routes, but also interfere with the rational employment of foreign vessels in the foreign carrying trade of a nation.

The second group are the imperial navigation monopolies covering the carrying trades to outlying possessions. Here the problem of overland competition is non-existent. Such monopolies have also been of the utmost importance in the development of the merchant marines of various nations. For instance, American shipping has secured notable advantages from the establishment of monopolies in the carrying trades to Hawaii, Alaska, Samoa, and Puerto Rico. British shipping engaged in the carrying trade of the British Empire was protected until 1849, and, indeed, would have shown little vigor otherwise. Discriminating duties gave vessels of Dutch nationality a marked advantage in the trade between Holland and the Dutch East Indies until 1872.[7] With the exception of the United States, however, nations have tended since early in the nineteenth century to reduce or abolish such monopolies because of their restrictive influence on imperial trade.

The third group consists of the monopolies unilaterally established by one nation with respect to its carrying trade to nonmaritime foreign nations. Such measures were formerly important,

[7] Saugstad Report, p. 374.

and governed the conduct of much of the foreign carrying trade during the sailing-ship period. Such measures usually specify that goods may be imported in national ships or in ships of the country of their origin, but, since the latter is unlikely to provide vessels, the entire traffic becomes controlled by the protecting nation. For instance, this was the effect of the British monopolies under the navigation system. The American Navigation Act of 1817 [8] had a similar effect, except in so far as reciprocity treaties nullified it. For example, American shipping in the China trade was protected against the competition of British ships, but not against that of Chinese vessels. Such measures may lead to retaliation, but this is sure to be ineffective if little national shipping is employed in vulnerable international carrying trades. A return to this old technique by the imposition of such measures at the present time, as is sometimes urged, would eliminate much tonnage belonging to third powers and employed in the American carrying trades to the Far and Middle East, South America, and Africa, and hence would expand American shipping to those nations over which it has an advantage.

The fourth group consists of those monopolies which are established in the carrying trades to rival maritime nations. In such cases the traffic is usually divided between the ships of the two countries, and vessels of third nations are excluded. Usually such monopolies have been established by means of a reciprocity treaty. For instance, the carrying trade between Great Britain and the United States was conducted under such conditions under the treaty of 1815. Measures of this sort also have become rare, although conceivably they may be reëstablished by the totalitarian nations.

Clearly a policy of establishing navigation monopolies may prove to be highly protective, and may serve to maintain large shipping and shipbuilding industries. In the past they have been useful devices for nations which, for financial or other reasons, have not wished to employ subsidies. They are, however, an anachronism in modern times. If they are widely employed the ordered routing of ships becomes impossible, much waste motion results, the costs of transportation are raised, and commercial wars of damaging extent arise. The result is that the commercial and even the military interests of all nations are injured severely.

[8] 3 U.S. Stat. 351 (March 1, 1817).

The tendency has been, therefore, to abolish monopolies in order that transportation costs may be reduced. This has been the policy of Great Britain and Holland, which have gone far since the middle of the nineteenth century toward opening their imperial carrying trades to foreign ships. France, Spain, and the United States, however, have followed relatively restrictive policies. The navigation monopoly, if it can be secured without serious retaliation, is the simplest and often the most effective device. It is particularly suitable for shipping industries in which competition is active, for then a policy of laissez-faire may be followed in other respects.

Those nations the shipping of which operates at a competitive advantage naturally have generally tended to favor free and unrestricted navigation in principle. Such was the case in the United States before the Civil War, and in Great Britain, Germany, and Holland after the development of the metal ship. On the other hand, where the reverse has been true, more or less protection of this type has been employed, mainly to provide a minimum fleet for use in a military emergency. In the United States, protection of this type enable a considerable merchant fleet to be maintained in the coastwise trade after the Civil War, despite extremely unfavorable cost differentials. The costs of American coastwise shipping services probably have been excessively high, however, and the navigation monopoly may be said, therefore, to have been highly protective and restrictive of commerce. In a highly developed capitalistic world, which requires a rational transportation system, the use of this technique appears to be a clumsy method of preserving shipping and shipbuilding capacity for defense purposes, and, if general, creates serious inefficiency. It is not surprising, therefore, that the shipping of the advantageously situated nations is continuously pressing against the protected trades, and that loud protests arise.

4

The principal alternative type of promotion policy is the ship subsidy. Subsidies have been employed for the purpose of stimulating maritime activities since early times. They were given in Venice and Spain at the close of the fifteenth century, in England under Elizabeth, and in France under Colbert.[9] During the

[9] F. P. Siegert, *Die Subventionen der Weltschiffahrt und ihre sozialökonomischen*

early years of the American government, subsidies were given to fishing vessels to enable them to compete with subsidized foreign craft. The early measures were, however, sporadic and of minor significance.

With the rise of steam navigation, subsidies rapidly came to the fore as the major device of navigation policy, and were used for many purposes. In some cases they were employed to establish pioneer services. In others they were used to expand national fleets generally. In Great Britain and the United States in particular they arose at first as special payments for exceptionally fast, regular service by first-class ships. Such service could not have been secured, it should be noted, by means of navigation monopolies, for the use of this device would only have expanded the fleets of windjammers. The use of subsidies has the advantage that the state may exercise wide control over shipping in such matters as size of vessels, speed, design, routes, and frequency of service. Another important consideration is the fact that subsidies are more difficult to counter by retaliation in kind. This is because many nations are reluctant to make grants to private contractors, and prefer to accept some of the very real benefits provided by subsidized foreign lines touching their ports. The use of subsidies may also enable economies of large-scale operations, and much important prestige and good will to be secured. Hence a subsidized line may soon become very firmly entrenched. Subsidies have also become the most effective means of supporting national shipping on routes on which the use of other techniques is undesirable. This is likely to be the case when there exist reciprocity treaties designed to secure free navigation, or when unfortunate tendencies appear toward the imposition of rival discriminations, which disrupt the transportation system. The trend has been, therefore, toward free navigation and the support of the national maritime interests to whatever extent appears to be justifiable by means of subsidies.

The nature of the ship subsidies which are used varies greatly, depending on the objectives of the government. Four distinct objectives may be noted, although at times all four are blended. In general these are somewhat different from those leading to the creation of navigation monopolies. The first objective is to im-

Wirkungen (1930), p. 1; W. Cunningham, *The Growth of English Industry and Commerce*, 2 vols. (1882), 5th ed. (1927), I, 413; II, 64, 483–486.

prove the transportation system on certain routes. Subsidies given for this purpose are usually small, and need not be necessarily given to national ships. Second, subsidies are given to improve national communications and defense by placing in service high-class, fast vessels of special types. Contract subsidies to mail ships are normally given for this purpose. Third, a general expansion of the national shipping industry may be desired. This may be secured by bounties or subsidies sufficient to secure the desired result, which may be given to all or many kinds of craft. Fourth, grants are also made to prevent the contraction of a part or all of a national shipping industry as a result of foreign grants and aids. In this case it is merely a countervailing subsidy designed to restore the status quo.

Shipping activity may be said to be subsidized whenever it is necessary for the government to make special financial grants for its support. This is a broad definition, but it covers a multitude of cases. It is, indeed, often difficult to determine the extent of the subsidies in effect in any nation, for in many cases there are many remote and indirect aids.

Although there are many different types of measures in use, they may be grouped into two important classes: namely, the contract subsidies and the general navigation bounties. The contract subsidy is a device for promoting the development of a shipping service on a particular route. Usually the contractor agrees to provide a regular service comprising a certain number of voyages annually on a given route in ships of given size, speed, and characteristics. Ordinarily a host of other provisions is added, including requirements that the vessels be suitable for naval or military service and be made available to the government in time of war on certain terms. In return a grant of a fixed sum per year is made to the contractor. It is important to understand the nature and results of such subsidies. They ordinarily result in the creation of large enterprises acting as contractors to the state, each one operating on an important trade route. This, for instance, was the result of the British mail contract subsidies which were established in the mid-nineteenth century. The same types of regional contractors have appeared in the development of American shipping since 1920. The use of the contract subsidy therefore often produces a type of enterprise closely related to the state, and one considerably affected with a public interest.

Although the contracts are often let by competitive bidding, such action often is a poor device for the determination of the amount of the subsidy. The established lines soon come to rely on the state, and the state soon is forced by circumstances to rely on its contractors. The abandonment of support of an established line usually causes hardship, and may lead to inefficiency in the subsidized services in general. No organization can develop effectively unless it is assured of a permanent relationship which justifies an orderly replacement program and the development of permanent business contacts. Furthermore, since unsubsidized lines can rarely compete in the same line of business with subsidized services, other national operators tend to disappear. It is rarely desirable to subsidize two contractors on the same route. Hence a mutual dependence develops between the state and the contractor. In a properly developed contract system, therefore, the services become, in effect, public utilities operated for the government by private contractors. These firms should be subjected to suitable regulation in respect to finances, profits, and operations. The failure to recognize these relationships has been until recently a major cause of difficulty in American policy.

Contract navigation subsidies normally create a fairly rigid system of shipping services, so far as routes, schedules, service, and vessels are concerned. The majority of these services radiate from the subsidizing nations to many regions. In the case of Great Britain, for instance, the major contract lines were established in the nineteenth century to North America, the West Indies and East Coast of South America, the West Coast of South America by way of Panama, the Mediterranean, and the Levant, India, China, and Australia. The French system, which was developed somewhat later, radiated from Le Havre for the Atlantic lines and from Marseille for those operating to Mediterranean countries, the Levant, and the East. In contrast, the American system prior to the World War was far from comprehensive, consisting of a handful of services operating, for the most part, out of New York and San Francisco. Since the World War, however, the revived American merchant marine has been organized into lines operating vessels on many key routes to all parts of the world and between various American ports under a contract system. At the present time the Maritime Commission believes that contract service should be maintained on twenty-three

trunk routes of American foreign trade.[10] Thus the United States has been in the process of creating an elaborate and rigid system, although at a late date.

It is obvious that such services may have a decidedly active influence on the localization of industry and on the course of trade. The actual routes selected by nations have been determined in the past in various countries by the needs of the postal and government communications systems, by political considerations, by the needs of trade, and by the desire to rival foreign services. Great emphasis has been placed at times in the British system on maintaining regular, rapid, mail service; hence cargo movements have received only minor attention. In the United States, under the Merchant Marine Act of 1928,[11] the Postmaster-General was also instructed to consider primarily the needs of the mail service. Under the present American policy, however, the needs of trade receive the principal consideration. The adaptation of the contract network to the requirements of commerce is clearly the most economical policy because full cargoes may be more easily secured and the emphasis on speed, direct routing, and regularity of operation need not be as great. Much depends, however, on the objectives which the government has in mind. In general, contract networks are not likely to be solely designed to maximize revenues, and hence they normally exercise a warping influence on trade and production.

Contractors usually provide a differentiated, high-grade service, and hence do not compete seriously with low-speed tramps and other ships. The payment of government funds may, in fact, merely cover the additional expenses caused by the provision of extra speed, regularity of service (especially in slack seasons), extra subdivision, and other military features embodied in the ships, by the establishment of a special liability for military service in time of war, and by other similar special requirements. Hence little additional cargo-carrying capacity may be created. To the extent that this is so, the effect on general freight rates may be small, for owners may have no incentive to expand their fleets. The early British subsidies were largely of this kind. Normally, however, extensive contract subsidies cause the placing in service of a considerable amount of additional tonnage, all or

[10] Kennedy Report, pp. 15–16.
[11] 45 U.S. Stat. 689 (May 22, 1928).

much of which may be of ordinary commercial types. Some of it may appear on routes where no line service formerly existed. Such action normally depresses freight rates, both on the subsidized route and later on others as well, for unsubsidized vessels are likely to be diverted to different employments. If the amount of the payment, therefore, exceeds the extra costs caused by the special features of the contract, the subsidized line is likely to force out of business unsubsidized national operators and some foreign tonnage. Even if this is not the case the improved service may be expected to attract traffic. In fact, if the policy is carried far enough, and especially if economies of scale are secured by the firms, the subsidized lines may dominate the important carrying trades, leaving merely a fringe of tramp competition.

Governments often experience great difficulty in determining the amount of money which should be given under a contract. The usual method employed has been to ask for bids for a specified service, the award being made to the lowest responsible bidder; or, alternatively, to ask for proposals. In initiating a service, however, it has been difficult in practice to secure responsible and informed bidders. Each firm generally has imposed certain conditions to meet its particular requirements. Furthermore, the costs of the vessels, the expenses of maintaining the service, and the amount of the patronage all have been at times badly estimated. These errors were particularly notable in the case of the ill-fated Collins Line of the 'fifties, and have since appeared many times in American practice. Such errors may easily result in the failure of the contractor and in the disorganization of the service, or, alternatively, in undue profits and a public outcry. These difficulties occurred in the cases of nearly all of the early American subsidized lines. Competitive bidding at the time of renewal has also been unsatisfactory in both British and American experience. It has been difficult to secure competent bidders who will risk competition with an established line. Furthermore, when such firms have appeared, the existing holder of the contract has often cut its bid too far in order to save its investment, with the result that the service has been impaired. When no new bidders have appeared the existing contractor has been, of course, in a monopolistic position. Hence, competitive bidding for contracts has been unsatisfactory as a method of determining the amount to be paid.

Furthermore, important difficulties arise because of the impossibility of foreseeing accurately the course of economic development during the period of the contracts. The same problems appear as are often encountered in fixing public utility rates in order to secure a fair return on a fair valuation to the investors. Shipowners must obligate themselves to provide a given service over a period of years regardless of changes in demand, costs, and foreign navigation policies. Considerable risk is encountered, therefore, both by the government and by the contractor. For example, the depression which began in 1929 wiped out many mail contractors operating under the Act of 1928 and prevented numerous others from fully carrying out their agreements. The inflexibility of many contracts and services therefore creates a dilemma. The subsidy may prove to be too small, with the result that the contractor may fail, or too large, with the result that though excessive profits may be made, there may occur no expansion of the service beyond the terms of the contract. There is also a danger that government subsidies will be wasted through high salaries, the operations of corporate affiliates, and improper financial practices. In this respect American policy has been very weak until recently because of inadequate control over the contractors. It is apparent, therefore, that a government should aim to secure efficiency and sound financial practices on the part of its contractors, but should have flexible controls over the size of the yearly grants.

Experience, both in the United States and abroad, indicates that the only sound procedure is to treat the contract services as businesses affected with a public interest and to regulate them in a suitable manner. Private capital can only be secured if contracts are reasonably long — at least as long as the life of the first ships built under them — and the relations with the state are more or less permanent. Sudden cancellations of contracts, or awards to newcomers, except for reasons of fraud, failure to perform, or inefficiency, are highly disturbing.[12] No orderly replacement program and little permanent economic development can occur in a state of uncertainty. Furthermore, means must be found to take advantage of the profit motive without endanger-

[12] See for instance *Hearings before the House Committee on Merchant Marine and Fisheries on the Discontinuation of the Subsidy to the Baltimore Mail Line* (1938), 75 Cong., 3 Sess.

ing the interests of either the state or the contractor. Contract services are undertaken in the public interest, and therefore the state should make sure that contractors are not left with inadequate resources. On the basis of experience, the best policy appears to be to allow some flexibility in the terms and amounts of the contracts, to regulate certain aspects of the contractors' operations, to assure a reasonable amount of permanence in the relationship, and to recapture a part of the earnings over a fair return. This, indeed, is the policy which has finally been developed in the United States in the Merchant Marine Act of 1936.[13] Long experience has clearly shown that the mere grant of money, followed by a policy of laissez-faire, is most unsatisfactory.

5

A different type of ship subsidy is the general navigation bounty. This method of subsidizing has not been employed up to the present in the United States, except to assist fishing vessels,[14] but it has played an important role in the navigation policies of France and Italy since early in the last quarter of the nineteenth century, and has been recently used in Great Britain to stimulate the construction and operation of tramp ships.

The nature of the general bounty is very different from that of the contract subsidy. First, no special services or fixed routes are established, and the subsidized ships are consequently left free to roam the seas as their owners direct. Second, the requirements regarding speed, subdivision, and other military matters are usually of comparatively minor importance, since this type of protection is employed mainly to aid freight ships. Third, the subsidy is given on a mileage basis to all owners whose vessels qualify. Hence, quasi-monopolistic contractors cannot easily arise. Fourth, owners may adjust the use of their tonnage to the needs of trade, and therefore the subsidy is comparatively passive in its influence on industrial localization. Fifth, and most important, shipowners have every incentive to expand their fleets to whatever size their judgment dictates, or to sell or lay up vessels if it appears desirable to do so. Sixth, little regulation of the shipowners is ordinarily required, since competition and self-interest may usu-

[13] 49 U.S. Stat. (pt. I) 1985 (June 29, 1936).

[14] L. Sabine, *Report on the Principal Fisheries of the American Seas* (1853), House Exec. Doc. no. 23, 32 Cong., 2 Sess.

ally be relied upon to produce satisfactory results. The general bounty is, therefore, a relatively simple and flexible device for the expansion of a national shipping industry.

The general bounty serves a purpose different from the contract subsidy. The latter is primarily designed to provide regular and superior national services on major transportation routes in order to increase trade and to improve the speed and reliability of communications. The general bounty, however, is a device for increasing the total size of the national merchant marine regardless of its employment. By suitable manipulation of the rates, the construction of sailing ships, oil tankers, or any other type of vessel may be particularly stimulated. For instance, in France prior to the World War, the building of sailing ships for the long-voyage trades was particularly favored by the bounty system, perhaps unintentionally. Since considerable competition usually prevails between the subsidized firms, especially if they are chiefly owners of tramps or low-grade cargo liners, and since they are free to employ their vessels wherever it appears desirable to do so, the system is a relatively effective and economical method of increasing the size of a national shipping industry. For a given sum a government can usually secure a larger addition to the tonnage of the national merchant marine in this way than by any other method. Such a policy may be conveniently used in conjunction with contract subsidies, as has been done in France and Italy. It is, therefore, a useful tool for governments which desire to expand the carrying capacity of their merchant fleets in order to increase their security in time of war.

The problems of control are relatively simple if general bounties are employed. In the type of shipping to which this type of measure is usually applied, namely tramp shipping, competition is relatively vigorous and may usually be relied upon to promote efficiency and induce expansion until profits are normal. This was clearly the effect of the French bounties to owners of sailing and steam freighters, which were given under the Acts of 1881, 1893, and 1902. Payments have usually been made on a basis of the number of sea miles sailed and the gross tonnage of the ship. Usually the rates have been different for various types of vessels. Special provisions have sometimes been made to prevent an excessive amount of navigation in ballast. In the case of the recent British tramp-ship subsidy the amount of the bounty de-

pended on an index number of freight rates. If the rates of pay are suitably adjusted and the bounty policy is reasonably stable there is ordinarily little need for regulation.

It is important to note that, if a nation is faced with a large, unfavorable differential in ship operating costs, the amount of money which may be required under this policy may be substantial. To begin with, the rate of the subsidy must be high enough to overcome the initial disadvantages, and the number of ships receiving aid may be large. Hence, when the obstacles to be overcome are great, the contract subsidy, which may be limited to a small number of vessels, is often preferred. The unlimited liability of the government under the bounty policy has, in fact, often been a drawback. Although general navigation bounties for American merchant ships, both sail and steam, engaged in the foreign and protected trades were frequently urged after 1870, all bills were defeated because of the expense.

6

The measures taken to protect or promote the various national shipbuilding industries are also of great importance. As has been shown, the shipping and shipbuilding industries may be conducted independently of one another so far as localization is concerned. The popular belief that a nation must build its own ships to be successful in shipping is an erroneous one. Nevertheless, the actual practice in the United States until comparatively recently has been to require the use of American-built ships in the American merchant marine. The registry laws until 1912 required American owners engaging in the foreign carrying trades to use only American-built ships, with some minor exceptions. They still require the owners operating in the monopolized coastwise carrying trades to do so. Likewise, nearly all of the ships employed in the subsidized services established under the recent laws have had to be of American build. Because of the circumstances, comparatively few foreign-built vessels have been used since 1912. Thus, in general, since 1789 the development of the American shipping industry has been made dependent on that of the domestic shipbuilding industry, and the two have been made to stand or fall together. To a large extent this policy has been based on an erroneous theory.

The arguments for the protection of the shipbuilding industry

have already been indicated. The primary problem is the extent to which it is desirable to do this. The use of highly protective registry laws is, in general, a questionable practice if there is a substantial unfavorable differential in shipbuilding costs. Such a policy either offsets a favorable competitive advantage in ship operation, or increases to a large extent an existing unfavorable differential. Under such conditions shipowners shrink from ordering vessels for the foreign carrying trades, unless they are subsidized or protected; the shipbuilding industry gains little or no business from this source; and the important coastwise shipping industry is retarded because of competition from overland carriers. The shipping industry, which probably is of more importance than the shipbuilding industry for purposes of defense, is thus stifled, with but little advantage to the shipbuilders. If, in addition, high protective duties are imposed on important shipbuilding materials normally secured from abroad, the case may become well-nigh hopeless. Such measures forced American operators to rely during the latter part of the nineteenth century on relatively cheap but inefficient wooden square-rigged ships and on great wooden schooners, although other nations were building large numbers of metal steamships. There was little American shipping employed on the routes on which metal steamships predominated, although resources of capital and entrepreneurial skill were available. These resources were largely employed, however, in financing and managing foreign-flag ships. Not until 1920, when it became possible to secure war-built steamships from the government at low prices, did American shipping enterprise begin to revive. British and French shipping was retarded in a similar manner during the first part of the nineteenth century. It may be concluded that the application of high protection to a shipbuilding industry operating at a disadvantage is usually quite ineffective in promoting either shipping or shipbuilding unless the shipowners can be protected adequately, and commerce on the protected routes can readily bear the resulting increases in charges.

It follows that a policy of free ships for both the coastwise and foreign carrying trade, coupled perhaps with a limited shipbuilding subsidy, is a requisite for the successful development of a national merchant marine if domestic vessel prices are unfavorable. This is true both under conditions of free navigation and laissez-faire and under circumstances of subsidized expansion.

The shipping and shipbuilding problems should be kept distinct. Ships should be purchased in the cheapest market in order that the economic position of the shipowners may be as favorable as possible. If it is held to be desirable to promote the shipbuilding industry, this may best be done by means of a special subsidy designed to enable owners to secure domestic-built ships at or below world prices. Such a subsidy may either be in the form of a general bounty based on tonnage available to all builders, or in the form of a special subsidy for the building of particular vessels. The latter is the method now in use in the United States under the Merchant Marine Act of 1936. This technique has the advantage of not hampering the development of the national shipping industry, while at the same time a certain amount of domestic construction actually is assured. Conceivably, if conditions are suitable, such a subsidy may even bring an infant shipbuilding industry into full maturity, and lower costs may result. If such a program is coupled with a stable and adequate program of warship construction there is no reason, indeed, why sufficient shipbuilding capacity to meet the needs of national defense may not be secured.

Shipbuilding subsidies, with the exception of those specifically given to increase the naval value of merchant ships, are usually designed to equalize the domestic and foreign costs of construction. For instance, this is the technique employed in granting shipbuilding subsidies under the Merchant Marine Act of 1936. Owners are thus theoretically to be placed on an equality with those of foreign nations so far as vessel prices are concerned. Such a technique must be judged, however, by its results, for it should be remembered that such subsidies are given usually to promote the development of a certain amount of national shipbuilding for military reasons. The test, therefore, is whether or not the desired shipbuilding activity develops at a minimum cost to the state. The differential is only an imperfect measure of this cost. These differentials are extremely difficult to compute in any case because ship prices vary widely in modern times, depending on the amount of business on hand in the shipyards, and vessels are rarely alike. Furthermore, it is difficult to determine which of the many foreign shipbuilding nations should provide the standard of comparison. If domestic owners are not given freedom to buy vessels abroad the figure representing the differen-

tial is especially likely to be arbitrary. It may be concluded that the differential in shipbuilding costs, in so far as it may be ascertained, is a rough measure of the portion of the cost of vessels which should be borne by the state if it desires to encourage shipbuilding, especially if there is a policy of free purchase for both subsidized and unsubsidized shipowners. If a free purchase policy is not in force, the shipbuilding subsidy merely becomes part of the total system of aid extended to the combined shipping and shipbuilding industries, and the grants may be divided between them in a number of ways.

7

We shall now turn to some of the secondary measures which are taken to promote the development of national maritime industries. Certain of these measures affect traffic. Among these may be mentioned tax regulations requiring the patronage of national vessels by the state itself whenever possible, favorable arrangements for the interchange of traffic with the state railways, and sometimes the coercion of shippers. Governments also influence the cost and quality of service by means of measures for the insurance of ships by the state at comparatively low rates, the sale of government-owned reserve ships at low prices, the provision of favorable rail rates on shipbuilding materials, the insurance of ship mortgages, the lending of capital at low interest rates, and the training of officers and men afloat and ashore. Important regulations also govern manning scales, wage rates, labor conditions in the shipping industry, load lines, passenger accommodations, the safety features of ships, and the professional competence of officers and men.

Probably the most important group of measures of this nature in use today concern the important problem of raising capital for shipping enterprise. As long as the shipping industry consisted of small-scale enterprises controlled by captains, merchants, and other interests concerned with shipping and trade, and competition and laissez-faire predominated, as was the case in the age of sailing ships, capital was easy to secure. The developments in the shipping industry in the last fifty years, however, have made it comparatively difficult to raise capital freely from private sources, not only in those nations the shipping industries of which operate at a competitive disadvantage, but also in those in which

conditions are comparatively favorable. There are several reasons for this development. First, increasingly large subsidies and other measures have reduced the returns of unsupported enterprises to a comparatively low level. Second, with the increase in the importance of state policies the economic risk attached to shipowning has increased, both because of the inflexibility of many contracts, and because of the political uncertainties associated with policies. In the United States in particular the political instability of navigation policy has become a major obstacle to private investment. Indeed, since the Civil War the experience of investors in American shipping enterprises has been almost uniformly unfortunate.[15] It has, therefore, been difficult to secure adequate supplies of private capital for the various expansion programs of recent times without the aid of governments.

Governments developing nationalistic shipping policies have, therefore, been greatly concerned to secure the capital necessary for the maintenance or expansion of their fleets. This they have done by means of loans to shipowners or guarantees of low-interest loans by private capitalists. Since the investment in large steel steamships is necessarily large, the interest rate has come to play an important role in the development of national merchant marines. The lowering of the rate from, say, 7 per cent to 3 per cent is sufficient in many cases to provide a substantial, or even overpowering, reduction in the total operating costs of service of the private firms. Competition in reducing capital charges has therefore become keen in recent years and has even become "cut-throat." The United States has, in fact, made loans under the Merchant Marine Act of 1928 at rates as low as one-eighth of one per cent. The amount of government investment has also tended to increase notably through construction loans, which in the United States have reached as high as 75 per cent of the cost of new ships, large loans for the purchase of government-owned tonnage, and other measures. Important advances and guarantees have likewise been made by such governments as those of Great Britain, Holland, France, and Italy. Thus there has been a marked tendency for the capital for shipping enterprise, which a hundred years ago came almost exclusively from private sources, to be supplied or guaranteed by many govern-

[15] United States Shipping Board, *Government Aid to Merchant Shipping* (1922), p. 86; Kennedy Report, pp. 26–33.

ments. Hence the equity of public authorities in shipping enterprise is large, and, conversely, that of private owners is often small.

8

It is not surprising, therefore, that public ownership in the shipping industry has been increasing. Such a growth is a logical result of the larger interest now attached by governments to their overseas transportation systems, and of the growing difficulty of operating private shipping in a world in which laissez-faire has largely disappeared, both as a shipping and as an industrial policy.

Public ownership has developed in four different ways. First, governments have found it impossible at times to secure private contractors for certain services. Second, it has been difficult to sell government-owned tonnage which has been acquired in time of war. Hence the alternative has been to establish government-owned services in order to secure some return on the state's investment. This was the cause, indeed, of the formation of the many lines of the United States Shipping Board following the World War, seven of which were still in operation in 1937.[16] Third, public ownership has resulted from the inability of governments to devise satisfactory techniques of administering subsidies. As has been pointed out, contract lines have tended to become dependent on governments, and the latter have tended to become dependent on the established operators. When in addition the state has had a large investment of capital in the subsidized ships or has made guaranties, the withdrawal of support has become difficult, if not impossible. Accordingly, when inefficiencies or scandals have developed or the lines have become weak financially, strong pressure for government ownership has arisen. Such pressure arose notably in the United States after the Merchant Marine Act of 1928 had been shown to be a failure. The contractors had been weakened by the depression, and serious scandals had been uncovered by the Black Committee.[17] Governments have frequently been forced in such cases to step in to protect both their own interests and the national transportation services

[16] Kennedy Report, p. 33.

[17] See *Hearings before the Special Committee on Ocean and Air Mail Contracts* (Black Committee), 9 parts (1934), 73 Cong., 2 Sess.

by buying the ships or by investing in the common stocks of shipping firms and appointing the principal officers. Fourth, government ownership has been adopted as a matter of general policy. Sometimes this action has resulted from political philosophies, as in the case of the Soviet merchant marine; at other times it has been a logical action resulting from government ownership of railroads or other properties. In some cases government ownership has appeared because of special circumstances, such as arose when the United States acquired the Canal Zone and the ships of the Panama Railroad. Governments thus have been forced by the changing economic conditions increasingly to develop their own fleets and otherwise to extend their investments in shipping. Such a result is a natural outcome of the increased emphasis placed on national services and of the general abandonment of laissez-faire.

As in the case of the railroads it is probable that no generalization can be made regarding the relative merits of subsidized private lines and those of government lines. Much clearly depends on the nature of a nation's general economic policy, the economic position of its shipping industry, and the efficiency of its administration. For long, private ownership has been the accepted and proven type of organization for the bulk of the world's shipping. Indeed it is only since the World War that general public ownership has been considered. As for the high-grade liner services, the British government in 1849 took the position, then probably sound, that contract carriers could provide a better service at lower cost to the state than the Admiralty packets.[18] This was also the view of the United States government until recent years. The experience of the United States since the World War, however, indicates that the profit motive may cause contractors to lobby extensively, syphon off funds, pad accounts, bribe officials, and generally waste government money, especially if they are extremely dependent on the subsidy and have little equity. On the other hand, the brief experience of the United States with its government-owned and operated shipping indicates that such enterprises may lack initiative, and may become seriously inflexible and unadaptable to the needs of the trade.

Probably in cases where private shipping operates at a serious

[18] *Report of the* [British] *Select Committee on the Contract Packet Service* (1849), Parliamentary Papers 1849, vol. XII, p. iii.

competitive disadvantage the best solution is a compromise. This would take the form of a mixed system of fully private, state-owned and privately chartered, and government-owned and government-operated shipping, such as has been developing in the United States since the World War. In any case it is essential that the solution not be made on a dogmatic basis. Government ownership has some advantages. It assures the provision of the necessary capital and ships, and enables the state to determine the characteristics of the vessels. It also may be a device to secure some economies in construction through mass production. The use of private charterers to operate state-owned ships promotes efficiency and flexibility. Since little capital is required by charterers, and the risks are comparatively slight, it has usually been possible to secure such firms without difficulty. If the charterers are subjected to commission regulation and are assured of adequate profits, such an arrangement appears to be satisfactory, provided the state is able and willing to supply the ships. It is notable that public ownership is most advanced, outside of Russia, in those countries in which unfavorable conditions for operation exist and large grants have been made.

It is important in this connection to note that the development of modern techniques and policies has made it difficult for a nation to pursue a policy of complete private ownership and laissez-faire in respect to shipping and to secure satisfactory results. Navigation monopolies, subsidies, discriminations, investments of state funds, artificial interest rates and labor costs, and similar interferences have destroyed the economic conditions on which it would be possible to justify such a policy. The adoption of strong nationalistic navigation policies by one or more nations inevitably must mean retaliation and the adoption of similar policies by others. Hence the older type of organization appears destined to play a smaller role.

9

It remains to consider the influence of navigation policies on the international shipping situation. It is clear that conditions have greatly changed since the nineteenth century. Then competition exerted a leveling influence which enabled supplies of tonnage to be adjusted to demand with reasonable rapidity. Even the imposition of navigation monopolies failed to prevent this force from working.

At the present time, however, conditions are very different. The development of large fleets operating under long-term contract subsidies has introduced a high degree of rigidity of supply into the system. Many vessels are required to sail on given routes and at given speeds according to agreement, whether sufficient cargo is available or not. The result is that if the cargo movement is inadequate, widespread rate-cutting may develop. On the other hand, if rates are maintained by agreement, as is usually the case, the cargo movement is divided among the operators, and vessels sail lightly laden. Such a situation is clearly wasteful of economic resources. The rigidity of the system is further increased by the provisions embodied in most subsidy plans and in programs for the development of state-owned shipping that a given number of vessels be built each year, or within a fixed period. Rival expansion programs tend to produce a chronic oversupply of shipping.[19] The result is likely to be the reciprocal imposition of countervailing subsidies, and in the end nearly all unsupported shipping is forced out of business. Thus, in general, the supply of subsidized tonnage tends to become insensitive to demand.

Subsidies have also altered the structure of the shipping system. They have been responsible for much of the great increase in the number of large fast liners. Since about 1840 world navigation policies have definitely favored line shipping as against tramp shipping in almost all maritime countries. This has been particularly the case in the United States, in which almost all of the subsidies since the middle of the nineteenth century have been granted to line operators. Great emphasis was placed under the Act of 1928 on securing large fast liners. Under the Act of 1936, however, the government has departed from this policy and has given subsidies to the owners of fast oil tankers suitable for use as supply ships for the fleet. The government has also favored moderate-sized cargo liners under this program. In Great Britain the owners of tramp cargo ships have also been recently favored for the first time. The result has been that line shipping and line organization have been artificially expanded, and the world's shipping system has therefore become more active in its effect on industry, agriculture, and trade than would have been the case had a policy of laissez-faire been followed.

[19] S. Helander, *Die internationale Schiffahrtskrise und ihre weltwirtschaftlische Bedeutung* (1928), chap. iii.

The organization of shipping enterprise has also been vitally affected by the regulations embodied in many subsidy policies regarding routes of operation, ports of call, and the scope of the services to be conducted by individual firms. In the United States from 1845 until 1936 it was the policy to employ a number of independent contractors or charterers, each of which was charged with one or two services. The present policy, however, is to consolidate the firms into regional combines. A similar policy is in effect in France, Germany, and Italy, where consolidation has gone far. In fact, in the case of the Compagnie Generale Transatlantique, for instance, a huge carrier operating vessels on many routes in the North and South Atlantic oceans has been evolved largely by means of French subsidy policies. It is impossible to determine how its large subsidies and overhead costs are to be allocated among the different services. Subsidies have therefore been of great assistance in promoting large-scale enterprise among liner operators. The tramp-shipping business is the only type of enterprise which has not been vitally influenced by subsidy policies. It may be concluded that if a policy of laissez-faire had been pursued by all nations the organization of the shipping industry would surely have been different from what it is today.

Navigation policies have also influenced transport relations and commerce. In general, where subsidies have been employed rates have been lower and service better than would otherwise have been the case. It is evident, therefore, that some types of traffic on some routes have not paid their full cost of movement. It must be remembered, however, that a considerable amount of the subsidy expense has been employed to maintain the shipping industry in uneconomical locations, and that much of this expense has had little influence on general rates. Indeed, in many cases rates for goods and passengers have been maintained by agreement, and the sole result of the appearance of additional tonnage has been to divide the traffic. On the whole, however, except where navigation monopolies have caused rates to rise, the effect of shipping policy in recent times has been to reduce the costs of transportation and to improve service. Therefore, international trade on a larger scale has become economically possible, and, indeed, has probably occurred, despite the rise of tariff walls in many countries. Certainly an increased concentration of industry has become possible as lower rates, and especially, better services

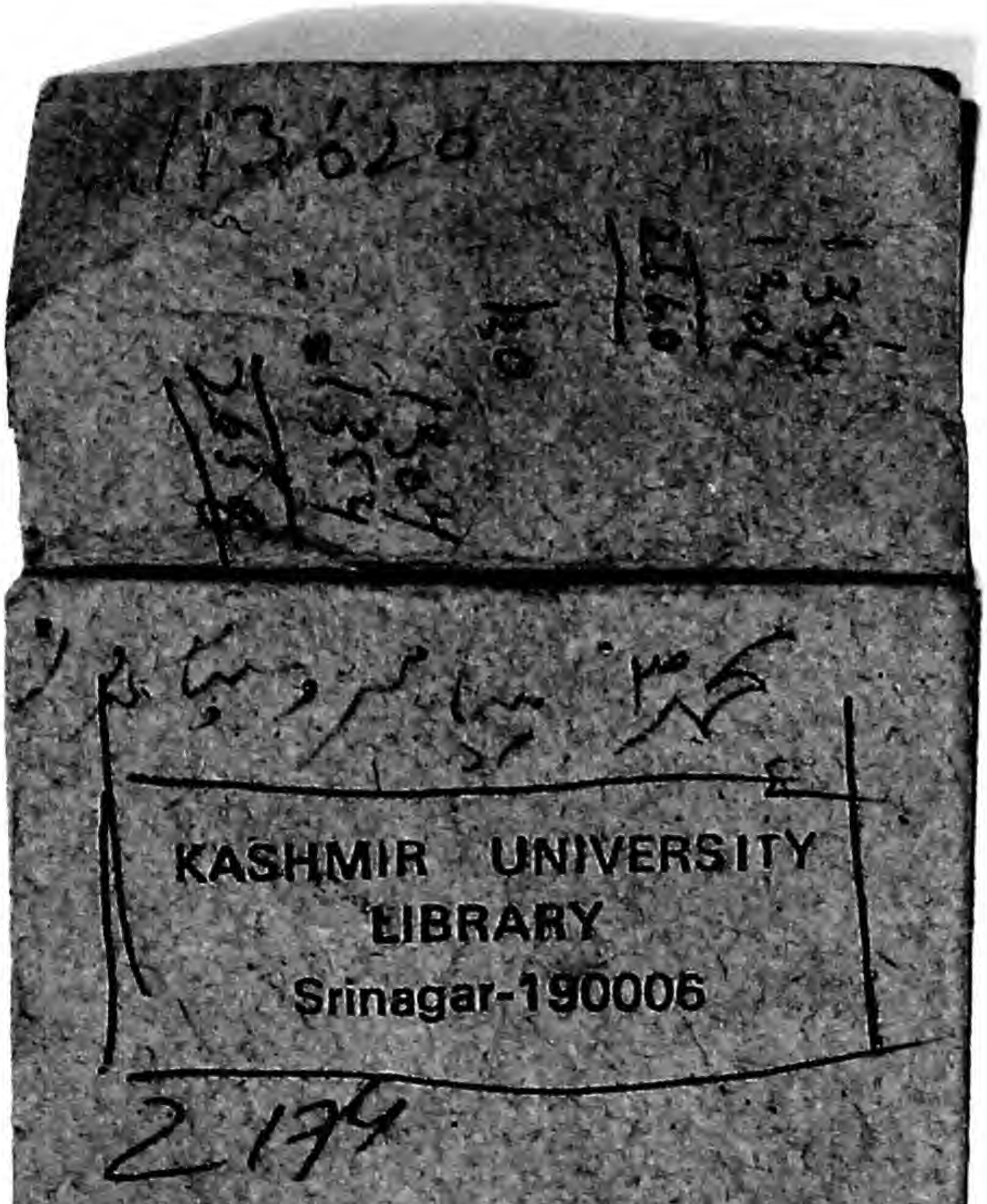
have become available. The influence of shipping policy on trade, and through trade on industry and agriculture, has therefore been very far-reaching.

The development of techniques adapted to the conditions and needs of the United States is of great importance. The best policy is clearly that one which enables the nation to secure at a minimum cost the transportation services and merchant fleet which are deemed necessary for its welfare and security, both in peace and war. Once it has been recognized that this is essential, the problem becomes one of selecting the techniques best suited to the situation. The maritime history of the United States is largely a history of efforts to devise suitable methods to meet the needs of each epoch.

We now turn to the economic history of the American Merchant Marine. The first problem which we encounter is that of the shipbuilding industry and the timber supply.

PART II

WOODEN SHIPS AND SMALL-SCALE ENTERPRISE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CHAPTER III

THE MARITIME INDUSTRIES AND TIMBER RESOURCES

I

THE NINETEENTH CENTURY was a period of particularly rapid change in the techniques of shipbuilding, the organization of the maritime industries, and the conditions governing the supply of the factors of production. During the three centuries prior to 1800 economic development had been substantial. During this period the technique of ship construction was greatly improved; long overseas voyages became possible; the geographical discoveries took place, and the foundations of the later huge intercontinental maritime commerce were laid. The changes of the nineteenth century, however, were of much greater magnitude in practically all respects. Change was especially rapid during the four decades from 1840 to 1880, during which developments of primary importance occurred in both shipping and shipbuilding. This four-decade period, therefore, may be aptly called the maritime revolution. Our attention will be largely centered on the economic developments of this century, and especially on those of this particular period.

The changes of the nineteenth century in shipping and shipbuilding may be divided into five groups. First, there was extraordinary progress in naval architecture, which became a highly complicated science. There were many significant improvements in the design and construction of sailing and steam-propelled vessels both of wood and of metal. These developments profoundly disturbed the localization of the maritime industries. Second, there were important alterations in the costs and sources of shipbuilding material because of technological changes, the exhaustion of resources, and economic conditions. Third, the expansion in the volume of oceanic commerce — especially that on the intercontinental trade routes, which was in part attributable to the technical changes in ship construction — was a factor

of major significance. During this expansion various maritime centers soon exhibited sharply rising costs and hence retired from further competition, while others found conditions of decreasing cost and increased the scope of their operations. Fourth, the institutional forms of both the shipping and shipbuilding industries changed. The simple, small-scale, individualistic enterprise of the early period gave way to the relatively large-scale, corporate business, which exhibited many of the monopolistic tendencies commonly found in a late stage of capitalistic development. Parallel changes also appeared in a number of other leading industries, especially in the United States, Great Britain, and Germany. On the whole, however, the older type of enterprise maintained its vigor for a longer period in the maritime industries than in industry in general. Fifth, many governments, which at first mainly used simple protective devices, developed during the course of the period more positive measures of support, which usually included the use of subsidies. After the World War these measures developed into full-fledged regulation, extensive, planned, and state-supported shipping systems, and sometimes into government ownership.

These developments, which from the standpoint of the economic historian occurred in a relatively short time, were profoundly disturbing to the maritime elements of the American economy. Prior to 1840 the primary maritime problems in the United States had been of a political nature, and had been created by wars and by the navigation monopolies and trade restrictions of imperialistic powers. Under the favorable conditions prevailing these problems were easily solved. After that date, however, there arose new economic problems of regulation, unfair competition, monopoly, and subsidization. The structure of the maritime industries, the business policies, and the measures of control and support all became more complex, and the economic conditions in the various maritime nations changed, with the result that the solution of the American shipping problem became more difficult. On examination of the petitions to and debates in Congress, and also of the reports of the numerous committees which in Congress and the British Parliament considered the shipping question, one finds that these primary changes greatly perplexed owners, builders, and seamen, and caused great concern to many governments. In the United States, as we shall see, the

results were particularly disturbing, and the authorities failed to comprehend fully the nature of the economic changes.

When the century opened, shipbuilding in the United States was on a firm foundation and seemed to be headed for a glorious future. From Passamaquoddy Bay to Charleston were hundreds of small shipyards backed by the best timber supplies in the world. The quality of the ships was good and was rapidly improving. The shipping industry which purchased these vessels was also extraordinarily vigorous. Profits were large and entry into the business was easy. American wooden sailing ships frequently outsailed their competitors, and because of their excellent construction often received preferential freight rates. American owners had secured nearly all of the direct foreign traffic, and also engaged extensively in the tramp-ship business between foreign ports. Secure in their superiority, they were pressing the government to obtain a relaxation of the discriminations established against them by foreign states.

In contrast, on the eve of the World War both industries were seriously depressed. The few remaining yards building wooden sailing ships were about to close, and the supply of ship timber was nearly exhausted. The operation of wooden sailing ships had become unprofitable. In the numerous shipping and shipbuilding towns bankruptcy and decay were prevalent. The construction of metal steamships, except for the coastwise trade, was also not flourishing. The work of developing the new world-wide shipping system then was unattractive to the enterprising capitalists of the nation. The collapse of the American maritime industries was nearly complete.

The causes of this change are of considerable economic interest; they were numerous and complex. One of the principal conditions of success in the economic struggle for sea power was a supply of good cheap ships. Differentials in the costs of building vessels between countries have been sufficiently great during most historical periods vitally to affect international competition, provided they have led to the payment of different prices by the ship owners of rival nations. For example, British ship owners were adversely affected by the British policy of giving protection to shipbuilders, which, however, was abandoned in 1849. Likewise, in the United States, in which from 1789 to 1912 owners were required to purchase none but ships built in domestic yards, the level

of shipyard costs and prices, and the condition of the science of naval architectures were of primary significance. Accordingly, considerable attention must be given to the condition of the shipbuilding industry in any discussion of navigation policies and shipping systems.

The primary costs in shipbuilding have been those incurred for labor and material. The labor cost naturally has been determined largely by the wage levels prevailing for skilled labor of various types similar to that used in shipbuilding throughout the country as a whole. The material cost has depended on the state of supply and demand for the primary materials, and on the costs of transportation and processing. In the economic history of the maritime industries the supply price of these materials has been a controlling economic force, especially during the era of wooden ships. In fact, the dominating influence in the shipping situation until the third quarter of the nineteenth century was the state of the timber supply. To a discussion of this we now turn.

2

Throughout the period of this study the conditions under which ship timbers were supplied were undergoing constant change. For several hundred years, there had been no equilibrium between the rates of growth and disappearance of timber in the western world. Because of the continued cutting of the forests at rates in excess of those of growth, shortages had frequently occurred in Europe since early in the fifteenth century. Shortages existed in Italy in the fifteenth century, in Spain in the sixteenth century, and in England and France in the seventeenth century. By 1800 the local supplies in many parts of the British Isles and the continent were nearly exhausted, and it was difficult to secure enough material for extensive shipbuilding in these regions. American supplies consequently acted like a magnet to draw the shipbuilding industry. In the course of the next sixty years, however, these also were seriously depleted. Hence there were regional movements within the United States as the forests of the seaboard were cut over. The rapid increase in the tonnage of the world's marine during this period notably accelerated these rates of depletion in the second and third quarters of the nineteenth century. Local resources, which had seemed ample in 1800, were exhausted with startling speed. New inland forests in the Ohio River valley,

Michigan, Minnesota, and Wisconsin, which were tapped by means of railroads and canals, were likewise depleted with astonishing speed. Thus the ship timber supplies of the world were depleted at an accelerating rate, and in the course of the process important changes occurred in the supplies of various shipbuilding centers.

When a committee of the British House of Commons investigated the complex navigation laws in 1847,[1] it soon discovered that the chief reason for the decayed state of the British shipyards was the high cost of securing good ship timber. Testimony showed that the poor quality and high cost of this resource severely diminished both the competitive advantages and the quality of British ships. Not much more than a decade later builders were, indeed, to complain that it was impossible to secure in England a sternpost for a Royal battleship. Both builders and owners reported that it was impossible to compete in the Atlantic trades with American ships, which were well constructed of the excellent live and white oak timbers then available in America in large sizes and at relatively low prices. Yet in America at the mid-century mark this valuable resource was already seriously depleted. Indeed, when Henry Hall visited the centers of the building of wooden ships some three decades later, he was to find the same evidence of decay which had been visible earlier in Great Britain. Despite these difficulties, however, builders continued to construct large wooden square-rigged ships and schooners until the World War, for in the United States metal vessels of this type were more costly. The timber supply was, therefore, of major significance in the economic history of the American shipping and shipbuilding industries until quite recently, and for years was mainly responsible for the prosperity of the American shipping industry.

The timber resources available for shipbuilding were much less than the total supply of timber in each region. The amount of timber economically available in each area depended on the nature of the forest and terrain, and on the costs of transportation. Shipbuilders were unfortunately limited to a relatively small number of tree species for each of the principal parts of ships. For the frames, white oak was usually preferred, though other woods were substituted if necessary. The density of the local forests and the amounts of such shipbuilding timbers as white

[1] *Report of the* [British] *Select Committee on the Navigation Laws* (1847), Parliamentary Papers 1847, vol. x.

oak, maple, and birch were, therefore, matters of primary importance to each shipbuilder. Shipbuilders also required trees of the largest size, especially for keels, sternposts, stems, frames, and spars. Ordinarily builders could use only sound, full-grown trees, which normally ranged between fifty and one hundred years in age. For this reason, during the period of the wooden ships in America, it was rarely possible to use second-growth timber. The mast problem, in particular, became acute with the diminution in the stands of virgin pine. The demand for large timbers also grew with the increase in the size of vessels, while the supply of such pieces tended to diminish with the depletion of the virgin forests. Furthermore, there soon developed a distressing shortage of the curved timbers necessary for special parts of the hull. The curving timbers which formed the deadrise of the floors, the turn of the bilge, the flare of the bows, and the tumblehome of the sides were all natural. Little hewing could be done on large frame pieces, for both physical and economic reasons, and the steam bending process for frames, which was developed about 1855, was never an economic success. The shortage soon became especially severe in the case of the right-angle bends out of which knees were made. Thus, in general, in the process of cutting off the ship timber of a forest region, shortages of trees of particular species, sizes, and shapes inevitably developed.

The cost of transporting ship timber was also a primary economic force determining the localization of the shipbuilding industry. Ship timber was extremely bulky and heavy, and the difficulties of transportation were correspondingly large. The weight of the ship timber commonly used in American shipyards ranged from seventy-six pounds per cubic foot for live oak to thirty-five pounds for white pine; unseasoned white oak, the most important timber, weighed fifty-six pounds per cubic foot.[2] The masts and spars were particularly heavy and awkward to move, a ninety-foot main yard weighing about seven tons. The weight of timber required to build a vessel ranged from between 90 and 125 tons for a small merchant ship of 300 gross tons to some 2000 tons for a live oak ship-of-the-line, the heaviest type of warship. The frames of a ship of the latter type weighed 1300 tons alone.

[2] Henry Hall, *Report on the Shipbuilding Industry of the United States*, Census Monograph (1882), p. 249. (Hereafter cited as the Hall Report.)

Facility in the securing of ship timber was, therefore, essential for the successful prosecution of shipbuilding. The costs of transportation depended on the location of the shipyards, the terrain of the hinterland, and the nature of the transportation system. So far as terrain was concerned, conditions in the United States were favorable during the major part of the era of wooden vessels. With the exception of the isolated Camden and Mount Desert hills in eastern Maine, the low-lying land stretched inland for miles to the foothills of the White Mountains and Alleghenies. Much of the land was flat or slightly rolling, and timber could be hauled by ox teams with considerable ease. Numerous sluggish rivers penetrated the coastal plain and provided access to a wide area. Another favorable circumstance was the geography of the coast, along which the many bays, coves, and navigable streams favored the dispersion of the shipbuilding industry along the coast, thus giving access to a wide forested region. In fact, in the important matters of forests, terrain, and coastline, the northeastern seaboard was a remarkably favorable region for the building of wooden ships.

The timber supply was generally secured under conditions of increasing cost. Until about 1835, it was possible to obtain supplies from near at hand at very low cost. Later on, as these forests were exhausted, shipbuilders exploited more distant areas, first by river and canal and then by railroad and coastwise schooner. Such shipment was relatively expensive, with the result that strong forces tended to eliminate shipbuilding centers with exhausted local resources. Those centers which were short of timber for the construction of ships of the largest classes frequently were able, however, to continue building smaller vessels for which the supply of small timber remaining was adequate. It may be seen, therefore, that in the United States the shipbuilding industry was based on the use of virgin natural resources which, although not irreplaceable, were nevertheless substantially so within the time limits of the problem.

3

During the age of wooden ships the quality of ship timber was a factor of primary importance in fixing the localization of the maritime industries, because of its influence on the cost of repairs, insurance, damage claims, and rates of depreciation. The varia-

tions in the durability of wooden ships were extremely great. At one extreme were ships which could be expected to be seaworthy for a maximum of perhaps only five years. At the other were vessels which often were serviceable for as long as sixty years. For instance, a large number of the small heavily built American whaling ships were often seaworthy for thirty years or more. It was necessary for shipbuilders to balance the advantages of great strength and durability and of low damage claims resulting from leakage against the costs of securing the necessary timber. British, French, Dutch, and Spanish builders were forced by circumstances to build many ships of the poorer classes. In the United States during the first third of the nineteenth century, however, the timber conditions were unusually favorable for the construction of ships of the highest class. To this fact one must attribute a substantial portion of the advantages in shipping possessed by United States shipowners at this time.

In choosing timber for its quality, shipbuilders regarded eight important points.[3] We have already considered the importance of suitable shape. The others are as follows. Of primary importance was resistance to the tensile and compressive strains arising in a loaded ship at sea. Second, hardness was desired in order to prevent injury due to blows or grounding. It was often possible to save ships after stranding, which was a common occurrence during this period, if their timbers were strong and resistant. Third, stiffness was essential if bending and warping and the resulting leaking and weakening of the hull were to be avoided. Since many vessels were allowed to rest on the bottom at low tide in numerous shallow ports from which trade was conducted, it was essential that they be able to bear the resulting strains. Fourth, light weight was important if speed and carrying capacity were to be secured. For instance, the strongest and most durable American timber, live oak, was frequently rejected because of its great weight, seventy-six pounds per cubic foot. In general, it was used only in ships in which the highest standards were essential, such as warships, Atlantic liners, East Indiamen, and whalers. Fifth, resistance to the most deadly enemy of wooden ships, dry rot, was a primary requisite. Many otherwise excellent timbers, such as those of the Pacific Coast, were frequently rejected owing

[3] W. W. Bates, "Ship Timber in the United States," *Report of the Department of Agriculture, 1866*, pp. 472–475.

to their susceptibility to this disease. Sixth, tenacity in holding fastenings was essential. Vessels built of soft woods frequently required refastening within a few years, and were consequently not rated highly. Seventh, builders ordinarily preferred timber which could be easily worked in the shipyard in order to reduce the cost of construction.

Shipbuilders generally found it difficult to satisfy all of these requirements. Only a dozen or so timbers were believed to be reasonably satisfactory. But since these woods often became scarce and costly a compromise often had to be made. The history of shipbuilding shows a continual endeavor to adapt increasingly limited forest resources to the needs of the industry.

Centuries of shipbuilding in northwest Europe had shown the superiority of certain timbers. The basic wood used for frames and planking, wherever possible, was the white oak, which showed remarkable resistance to decay.[4] On the continent, from the Adriatic [5] to the Baltic, oak had been used for warships and the best grade of merchant ships since early times. In England, where the white oak flourished in the clay soil and moist air, it was considered to be the ship timber par excellence. Rarely were other woods used either in the King's ships or in the highest classes of merchant vessels. Other timbers sometimes used were elm, beech, and fir.[6] The latter was an inferior material which was employed in the second-grade merchantmen, especially during the great timber famine of the nineteenth century, and in warships when hurried construction was necessary. It was cheap and light, but tended to decay rapidly.[7] Masts and spars were generally constructed of Baltic fir or American white pine.

Of the five hundred or more species of trees found in North America,[8] hardly a score were used extensively in the building of wooden ships. The remainder were useless, mainly because of their lack of strength and resistance to decay, the conservatism

[4] R. G. Albion, *Forests and Sea Power, The Timber Problem of the Royal Navy, 1652–1862* (1926), pp. 16–17.

[5] F. C. Lane, *Venetian Ships and Shipbuilders of the Renaissance* (1934), chap. xii.

[6] Albion, *Forests and Sea Power*, pp. 15–16.

[7] Albion, *Forests and Sea Power*, pp. 26–27.

[8] J. E. Defebaugh, *History of the Lumber Industry in North America*, 2 vols. (1906), I, 25; citing G. B. Sudworth, *Check List of the Forest Trees of the United States* (1898).

of the shipbuilders, or inaccessibility. The primary timbers used in the frames of American ships were white and live oak.[9] Cedar and locust were also first-class woods, but their use was restricted to the top timbers and other small pieces. The white oak was by far the most important because of its accessibility and abundance and of the tradition associated with its use. It may be said, in fact, that the development of the American shipbuilding industry was primarily controlled by the supply of white oak for ship frames. The other primary frame timber, the live oak, which was a growth of the southern states, was not introduced into ships until the beginning of the nineteenth century. Although it was the strongest and most durable of American frame timbers, and for a time was widely used, its great weight and the high cost of procuring it sufficed to eliminate it from consideration by the end of the Civil War. Cedar and locust, although also highly satisfactory, were not available in sufficient quantity and adequate size for general use in large ships. Hence the white oak was the principal raw material of the shipbuilding industry.

A secondary supply of poorer frame timber, consisting of woods of somewhat less strength and resistance to decay, was also available. In this category were beech, maple, black and yellow birch, black and yellow oak, white-heart chestnut, hackmatack, white ash, hickory, and spruce.[10] Of these, the hardwoods were frequently employed by the builders from the Virginia capes to Maine. The spruce of eastern Maine and Canada was also successfully used, although such soft-wood ships possessed a poor reputation. Frequently these timbers were substituted for oak in certain places only. For instance, hackmatack was commonly used for the upper futtocks. In general, however, these timbers were only introduced as a result of economic pressure. The depletion of the forests therefore set in motion forces tending to diminish the quality of wooden ships.

A few other woods were used elsewhere in the ship. The planking of ships was at first also of white oak, but when this wood became relatively costly to secure, the shipbuilders turned to the hard pine of the South, which was abundant, durable, and very desirable because of its length. Decks, fittings, and joiner work were usually of white pine or spruce. Unlike British builders,

[9] Bates, "Ship Timber," pp. 472–477.
[10] Bates, "Ship Timber," pp. 472–477.

those in America rarely employed Indian teak as planking because of its comparatively high price. The principal spars of American ships were for many years of white pine, which was both the most available and the best mast material in the world. When this became scarce, use was made first of southern pine, of which built-up masts were often made, and later of the Oregon pine, which was transported by rail over the new transcontinental lines. It is with the supply of these few species of frame, plank, and mast timber that we are concerned.

The durability of merchant ships depended not only on the kind of timber used but also on the care used in its cutting. In the latter respect, standards declined during the nineteenth century. A proper selection of timber was essential if speedy decay was to be avoided. The dry rot which caused this decay was a fungus growth which was all but invisible on the outside, except for little toadstools, but which honeycombed the timbers, weakened them, and eventually reduced them to powder.[11] Stagnant air, moisture, and heat were the conditions essential for its development, and hence the unventilated parts of merchant ships, as the fore peak, counter, and bilges were the areas usually first attacked.[12] Ships built of green timber which was improperly stored after cutting and of timber containing sapwood were particularly liable to be destroyed.[13] The ravages of this disease had been for centuries a serious problem for the shipowners of the European nations and had even caused the weakening of war fleets within two or three years of construction.

American shipbuilders were able to reduce the risk of decay in three ways. First, the abundance of large-sized timber enabled builders to cut away much or all of the soft outer sapwood, which was porous and subject to rapid deterioration, and thus leave the hard, durable heartwood. Secondly, builders were able to cut timber at will in the woods in winter, when the sap was out of the trees. Such wood was more durable than timber cut at other seasons. Third, they were able to cut timber close at hand, and to store it in the open until it was used. Timber which had to be shipped by sea, as was much of that used in European shipyards, was often loaded wet, was kept in the hot,

[11] Albion, *Forests and Sea Power*, pp. 11–13.
[12] Albion, *Forests and Sea Power*, pp. 11–13.
[13] Albion, *Forests and Sea Power*, pp. 13–14.

battened holds of vessels, and hence frequently began to decay before it was used in construction. Many cargoes are said to have arrived in England from the Baltic in a poor condition for this reason.[14]

Thus it is not surprising that the ships built for domestic account during the eighteenth century and the first part of the nineteenth century were remarkably durable. Some of the ships built for foreign account, especially in the colonial period, were constructed of inferior timbers, however. Unfortunately, this favorable situation could not last. After the Civil War the growing shortage of large timbers of the best kinds, the declining opportunities for selection and winter cutting, the demands caused by the increased size of ships, and the necessity of shipping supplies coastwise in schooners led to a deterioration in the quality of American tonnage.

4

Since white oak was the primary shipbuilding timber, it follows that the costs and qualities of this timber as delivered in the various shipyards of the world were of major importance in the development of the shipbuilding industry. This timber was widely used in the keels, stems, sternposts, floors, futtocks, and beams, which were the heaviest and most bulky pieces in a wooden ship. Hence the white oak forests were of tremendous attractive force.

The white oak possessed nearly all of the attributes of good ship timber, and consequently was used in nearly all first-class ships except war vessels, packets, and whalers, in which extreme durability was desired. It was regarded as the most useful timber used in shipbuilding.[15] It was tough, strong, and easy to hew and bend. Its weight of fifty-six pounds per cubic foot was not excessive in relation to its strength, as was the weight of live oak. Although the tannic acid which it contained tended to corrode iron work, it made the wood highly resistant to worms.[16] If properly seasoned, it was more resistant to dry rot and other forms of decay than any other ship timber of the temperate zone; [17] properly built oak ships were normally expected to be

[14] Albion, *Forests and Sea Power*, pp. 13–14.
[15] Bates, "Ship Timber," p. 475.
[16] Albion, *Forests and Sea Power*, p. 16.
[17] Hall Report, p. 243.

serviceable for fifteen years or more. Oak was tough and resilient, and could withstand the shocks of stranding and gunfire better than most woods. The large diameter, the curves of the limbs, and the many crotches provided a rich assortment of stems, futtocks, floors, knees, and other essential shaped pieces. It was, however, not as satisfactory when used as planking because of its high coefficient of expansion when wet, which frequently caused leaks and cargo damage.[18] For frame timbers, however, it was long considered to be absolutely essential by the eastern shipbuilders.[19] It was even sent around Cape Horn to shipyards on the Pacific Coast after the Civil War.[20]

The American white oak, *Quercus Alba*, is found along the eastern seaboard of the United States. During the period of American maritime ascendency, large specimens grew luxuriantly from southern Maine to Georgia. On the coast of Maine, however, it was a minor species north of Portland, and it grew in insufficient volume in the Maritime Provinces to support much shipbuilding. To the west, it grew in abundance in the Ohio valley, Michigan, Wisconsin, Minnesota, and southern Quebec.

Since the supplies which reached the shipyards by rail were negligible until after the Civil War, the quantity locally available was of primary importance to the builders of each port. The supplies within hauling or rafting distance of some of the shipbuilding centers proved to be ample for many years, but at others they were inadequate. In Maine, where the clearing of the land proceeded slowly, good trees were found for many years in some of the river valleys and ports of the coastal plain. From the Piscataqua to the Carolinas, the many waterways also penetrated deeply into luxuriant forests containing much white oak, and here also in many places supplies were secured over long periods within the local watersheds. Everywhere at first the supplies were abundant. Hence for some time, the industry was dispersed along the coast, supplies being obtained in each case by means of ox teams and local waterways. The prosperity of some of the centers slowly ebbed, however, as the available material was cut off and increasing costs were encountered.

[18] Bates, "Ship Timber," p. 475.

[19] G. B. Emerson, *Report on the Trees and Shrubs Growing Naturally in Massachusetts* (1846), p. 19.

[20] Bates, "Ship Timber," p. 475.

The quality of oak varied considerably from region to region. Few trees are more fastidious than the oak, which thrives best on the moist, deep, clay soil and moisture-laden air of the river valleys and coastal plain. Hence ship timber was valued according to its origin.[21] That grown within sixty miles of the coast between the Chesapeake and the Piscataqua was most prized. Southern and western timber was frequently considered to be inferior. It is evident, therefore, that the development of the shipbuilding industry resulted in the cutting of the largest and most durable timber first, and that later supplies were of inferior quality.

The best white oak in the world was claimed by Englishmen to be that of the southeastern counties of England, the *Quercus Robur*.[22] The rich clay soil and moist channel winds were responsible for the luxuriant forests of oak which originally were found in this region. To this the American oak was believed to be inferior by a number of authorities. As early as 1696, American oak had been rejected by the officials of the Deptford Dockyard, and this disfavor persisted until the end of the age of wooden ships of war.[23] American authorities agreed in this view. For instance, in 1830, the shipbuilders of Philadelphia complained that British yards possessed an advantage because of their oak,[24] and the same point was urged two years later by Levi Woodbury while advocating the conservation of live oak for the Navy.[25] Thus, had British white oak been more plentiful, American shipbuilders might have been in this respect at some disadvantage. Actually, however, differentials in the quality of ship timber were usually of less significance than those in price.

The shipbuilding industry of the United States was supplied during the eighteenth and nineteenth centuries mainly with virgin or first-growth oak timber. White oak supplies for the large ships came from trees between fifty and one hundred and fifty years

[21] Bates, "Ship Timber," p. 473; Hall Report, p. 243.

[22] Albion, *Forests and Sea Power*, p. 17.

[23] Albion, *Forests and Sea Power*, p. 24.

[24] *Memorial of the Shipbuilders of Philadelphia* (1830), House Rep. no. 369, 21 Cong., 1 Sess., p. 3.

[25] Levi P. Woodbury, *Historical Statement on the Use of Live Oak Timber for the Construction of Vessels of the Navy*, etc. (1832), House Doc. no. 23, 22 Cong., 2 Sess.; reprinted in *American State Papers, Naval Affairs*, vol. IV, no. 488, p. 202. (Hereafter the latter source is cited as A.S.P., N.A.)

of age. The stocks of well-developed and mature oak on hand about 1815 were particularly important. Owing to general cutting and the clearing of the land, the supplies allowed to reach maturity were relatively small during the years of severe drain, which began soon after that date. With the exhaustion of many of the virgin forests after the Civil War, shipbuilders did attempt, indeed, to use small, second-growth oak, but this supply was unsatisfactory because the trees were too small and it was necessary to use a large amount of the sapwood. Hence the development of the shipbuilding industry was certain to be restricted by the depletion of timber resources, which were for the time being irreplaceable. Some depletion of the enormous forests which covered the United States was, indeed, inevitable and desirable, but the unrestricted use of private forest lands resulted in a rate of cutting of ship timber which threatened to halt the prosperity of the maritime industries. In general, therefore, the shipbuilding interests, which were dependent on a limited supply of fully matured timber, were aware of the problem of conservation earlier than were other interests.

Three periods may be distinguished in the history of the construction of wooden ships. During the first period, which came to an end about 1800, ship timber was for all practical purposes ubiquitous in the settled areas of North America. In the second period, which ended about 1880, the rate of depletion was rapid and local famines developed. In the third period, which began at that time and closed with the cessation of the building of wooden ships, there was a general shortage. The rate of depletion in each area depended on the shipbuilding demand, the agricultural development of the area, and the rate of cutting for lumber and firewood. Shipbuilders had to compete with lumbermen for the supply of large timber. It was cheaper to use a big tree for boards than smaller ones, and hence much valuable ship oak and pine spar timber went to the saw mill. The clearing of the land also led to the rapid cutting of both mature and young trees, many of which went to the mills or were used as firewood. This dumping of timber on the market frequently produced a situation in which the price failed to indicate the growing shortage. Thus timber-growing gave way to cultivation in many regions, notably in the cotton states, and in the fertile river valleys of southern New England and the Middle States. In contrast,

the survival of the shipbuilding industry in Maine and New Brunswick was largely due to the fact that the severe winters and barren soil discouraged agriculture.

During the period of developing local timber famines, which immediately concerns us, numerous signs of distress appeared in important northeastern shipbuilding centers. In many areas it became necessary to haul white oak timber by ox team up to distances of about twenty miles, which was approximately the economic limit for this type of transportation. Those centers which lacked good inland waterways suffered particularly. Thus at Salem, Plymouth, Hanover, Scituate, Barnstable, Fall River, Newport, and Bristol, where there had been shipbuilding for years, the industry was decadent by 1830. At Boston the builders faced a shortage of local oak supplies soon after 1800. Some moved to the outlying villages of Medford,[26] Quincy, Milton, and Braintree, where substantial supplies existed within short distances. The opening of the Merrimack Canal in 1803, however, which enabled white oak supplies from New Hampshire to reach the port, soon greatly alleviated the situation.[27] Indeed, one of the reasons given in 1818 for the establishment of a navy yard at Boston was the size of the oak and pine supply available there.[28] In contrast, many of the centers which lay on large rivers faced little difficulty until after the Civil War. For instance, New York was able to tap a vast area of oak forests along the Hudson, Mohawk, and Raritan rivers, and after 1825 it drew on other areas by means of the Erie Canal and Great Lakes shipping. Likewise in New England the shipbuilding industry flourished along the Penobscot, Kennebec, Merrimack, Piscataqua, and Connecticut, which had extensive oak supplies along their shores.

A special problem encountered in securing the timber supply was the tendency toward a shortage of certain shapes. Curved timbers were essential in many parts of a wooden ship, notably in the floors, which were of a very broad V-shape, and the futtocks, which were the pieces comprising the ribs. It was particularly important to secure the correct bend for the turn of

[26] H. French, *The Thatcher Magoun, an American Clipper Ship, Her Owners, Captains, and Model* (1934), pp. 4–5.

[27] Christopher Roberts, *The Middlesex Canal, 1793–1860* (1938), pp. 117, 120, 166, 172, 186.

[28] *Reports of Surveys by Naval Officers* (1818), Senate Doc. no. 104, 15 Cong., 1 Sess., p. 12.

the bilge. A camber was required in the deck beams, and the knees, on which they rested, had to be right-angle bends. Only the keel, sternpost, and keelson, among the heavy timbers, were straight. These curved pieces were secured from the natural bends of the oak and other trees. Accordingly, timber from trees growing in the open, known as pasture-grown stock, was preferred. Such trees developed larger curved limbs than those growing in forests, and hence were more valuable for shipbuilding purposes.

It was inevitable that many of these natural bends of certain types should become rare as depletion progressed, especially in timber of the largest sizes. In England difficulty was encountered as early as the eighteenth century in securing oak of a suitable shape for the "great and compass" timbers, as they were called.[29] In 1804 curved futtocks were bringing a price double that of straight oak. In the United States, however, little difficulty was encountered prior to 1815, because of the ample supplies of oak and the small size of the American ships then being built. Subsequently, however, many problems arose. It proved to be particularly difficult to secure natural bends for the new, large ships because the limbs of the oldest and largest trees, which were required, were often brittle or rotten,[30] and such trees were becoming scarce. The practice of hewing out pieces of the proper shape was accordingly adopted, but the waste, which often amounted to from a third to a half of the volume of the log,[31] made the practice costly, and in addition, the resulting cross grain weakened the frames.[32] For these reasons many builders turned to substitute timbers such as maple, beech, and hackmatack whenever possible, and consequently ships of mixed frames became common. In England, the composite ship, which had iron frames, was developed in the 'sixties and proved to be popular for a decade.

Usually a shortage of knees also appeared. A two-decked vessel required from two hundred to five hundred such pieces, which were a vital part of the structure. Originally these pieces were cut from the crotches of white or live oak trees, but when these became scarce recourse was had to the roots of spruce and

[29] Albion, *Forests and Sea Power*, pp. 5–7.
[30] Bates, "Ship Timber," p. 475.
[31] Hall Report, p. 243.
[32] Bates, "Ship Timber," p. 484.

hackmatack trees, which make sharp angles, and to iron. Iron knees were sometimes fitted in American whalers and packets, and were frequently used in England, but they were not popular because of their influence on the compass.[33]

The rapid rate of depletion of the white oak supply was, therefore, a potential cause of serious difficulty. Shortages meant longer hauls, greater difficulty in securing desired shapes, more hewing in the shipyard, and the use of inferior substitutes. Nevertheless, no action looking toward the conservation of this important maritime resource was taken by the federal government. It may be concluded, therefore, that in the absence of a closer correspondence between the growth and consumption of white oak frame timber, the economic position of the American shipbuilding industry was certain to deteriorate, both absolutely and relatively.

5

In addition to the white oak, the American shipbuilding industry had available, as has been mentioned, a limited number of other timbers suitable for frames; namely live oak, locust, ash, beech, birch, chestnut, and hackmatack. Of these the most valuable was the live oak, or *Quercus Virginiana*, which rivaled the teak of India as a shipbuilding material and was secured solely in the United States. Most of the other species were used as substitutes for white oak when economy in construction became essential, but live oak was a far superior and much more costly wood.

The American live oak possessed many of the properties essential in frame timber to a high degree, excelling especially in strength and durability.[34] It was a short, stocky, evergreen tree, the trunk of which often exceeded twelve feet in circumference at maturity. The live oak, therefore, was particularly suitable for the floors and futtocks of the largest wooden ships. Since the trunk was rarely straight and there were many heavy branches, a maximum quantity of curved timber and knees could be secured

[33] L. V. Briggs, *History of Shipbuilding on North River, Plymouth County, Mass.* (1889), p. 8. It is said that iron knees made by Thomas Bardwin were used as early as the eighteenth century. According to Professor R. G. Albion iron knees were also fitted on the Black Ball liner *Albion*, which was built in 1819.

[34] Bates, "Ship Timber," p. 477.

from each tree, though the length of the pieces obtained was less than in the case of white oak. The wood was compact, fine-grained, resistant to dry rot, and heavy. Its high preservative properties made long seasoning unnecessary, but when vessels built of it were allowed to stand in frame for several years, as were many warships, it became practically indestructible. There was little difference between timbers cut in winter and in summer, and the white sapwood was considered durable enough for use, except in warships. There was no acid to attack iron fastenings as there was in white oak, but its grain did not permit of spike fastening. It is, therefore, little wonder that this wood was highly prized by shipbuilders, and formed the frames of many of the finest frigates, battleships, packets, clippers, and mercantile vessels constructed in this country.

The durability of live oak ships was remarkable. When subjected to the decaying influence of stagnant air and steaming heat they showed a resistance far beyond those of white oak. Some builders believed that live oak ships would last a hundred years.[35] Levi Woodbury, when Secretary of the Navy, placed the life of an American live oak warship at between forty and fifty years, compared with between ten and fifteen years for one of English white oak, and between six and ten years for one of fir or mixed frame.[36] Several naval commanders estimated that live oak was five times as durable as the white oak.[37] Certainly the durability of the live oak ships of the navy was remarkable. When the frigates *Constitution*, *Constellation*, *United States*, and *Congress*, all of which had been built before 1800, were examined in 1832, their frames were found to be in good condition, although all had been replanked with white oak several times.[38] Of the 974,363 cubic feet of live oak purchased by the Navy between 1797 and 1832 and placed in warships, it was estimated in the latter year that but 8000 cubic feet had decayed.[39] Ships then in commission contained 165,480 cubic feet, those in ordinary, 322,633

[35] Hall Report, p. 248.
[36] Historical Statement on Live Oak, pp. 195–196.
[37] Statements of Captains Barry, Dale, and Truxton, U.S.N., *Report of the Secretary of War on the Construction of Frigates under the Act of March 27, 1794* (1794), House Doc., 3 Cong., 2 Sess.; reprinted in A.S.P., N.A., vol. 1, no. 2, pp. 6–8.
[38] Historical Statement on Live Oak, pp. 196–197.
[39] Historical Statement on Live Oak, pp. 196–197.

cubic feet, and those on the stocks building, 354,000 cubic feet. The remainder of 132,250 cubic feet had been captured, sold, burned, or lost in shipwrecks. In contrast the British navy frequently found its ships unfit for service in less than five years, and in at least one case a new ship never even went to sea because of rot.[40] Unseasoned white oak ships built in New England likewise often decayed rapidly, an example being the huge white oak Indiaman *Massachusetts*, which was in decay when she reached China on her maiden voyage. Hence, as early as 1797, such a noted constructor of warships as Joshua Humphreys considered that the conservation of the live oak supply was essential if American sea power and shipping were to be furthered.[41] Soon afterward the requirements of the Navy caused the establishment of the first conservation policy.

There were, however, a number of disadvantages in the use of live oak which were more important in the case of merchant-ship construction than in that for the Navy. Its great weight of seventy-six pounds per cubic foot, which was 36 per cent greater than that of white oak, was a drawback in merchant ships dependent on carrying capacity for revenue. Furthermore, the wood was a product of the South, a region which was unfavorable for shipbuilding because of a lack of skilled labor. Also it was difficult to secure and costly to transport. Finally it was a hard material to work in the shipyard.

The use of live oak was, therefore, never general, but was confined to a small number of high-grade vessels and yards. Its value as a ship timber was recognized in the South as early as the mid-eighteenth century,[42] but it was not introduced in the northern yards until after 1800 because of the ubiquity and cheapness of the northern oak. It was used extensively during the following sixty years in vessels in which strength and durability were of special importance. It was the primary frame timber used in the United States Navy. Warships were costly, slowly

[40] Albion, *Forests and Sea Power*, pp. 229, 394–395. Pepys is said to have found new ships ready to sink at their moorings from dry rot. Ordinarily white oak ships decayed rapidly only if improperly built of green timber and allowed to remain unventilated.

[41] Statement of Naval Constructor Joshua Humphreys, *Report on the Construction of Frigates under the Act of March 27, 1794* (1794), A.S.P., N.A., vol. I, no. 2, pp. 8–9.

[42] J. L. Bishop, *History of American Manufactures from 1808 to 1860*, 3 vols. (1866), I, 85.

built, and often laid up for long periods, and accordingly protection against decay in vital places was essential. It was also frequently used in the famous Atlantic packet ships, in which strength and durability were highly essential; in whaling ships, which made three- and four-year voyages and hence required protection against rot; and in occasional cotton carriers, California and Oriental clippers, and general freighters. Professor Albion, in a valuable compilation covering fifty-eight packets, has shown that in seventeen of these packets live oak was used in whole or in part in the frames.[43] It was rarely employed throughout, however, owing to its great weight and high cost, the chief uses being in the floors and lower futtocks. With the intensification of competition after 1830, its use declined rapidly,[44] and after the Civil War it became a rarity. Abroad, shipbuilders apparently found the material too costly for general use in merchant ships. However, naval constructors, who prior to the Revolution had shown little interest in the timber owing either to conservatism or ignorance, recognized its value and employed substantial amounts. They pointed out, however, that the cheapness of this material in American yards gave American builders a notable advantage in the construction of high-class warships.

The supplies of live oak came from a limited region extending along the southern coast and its outlying islands from Virginia southward to Florida and westward to Texas. Rarely was the tree found more than sixty miles from the seaboard. The supply was on the whole extremely limited. The trees were thinly scattered among the hammocks, or high spots, of the moist lowlands along the coast and were relatively difficult to secure. Owing to its high specific gravity the timber could not be rafted, and it was, accordingly, necessary to haul it with oxen over soft ground to flatboats, which carried it down to the waiting schooners. The supply was therefore limited to trees standing within a short distance, usually not over sixteen miles, and often much less, of navigable waterways.[45]

During the first quarter of the century, the available supplies were seriously limited. As in the north, the most available trees

[43] Albion, *Square-Riggers on Schedule, The New York Sailing Packets to England, France, and the Cotton Ports* (1938), Appendix IV.

[44] Historical Statement on Live Oak, p. 199.

[45] Historical Statement on Live Oak, pp. 192, 199, 204–214.

were cut first. In addition, in many cases, those lying on land fit for cultivation were quickly cut off and sold at any price which could be secured, or else were girdled and eventually burned.[46] Hence the stumpage prices, which were as low as ten cents per cubic foot, failed to reflect the exhaustion of the supply.

Although it was reported in 1797 that the supply suitable for ship use was ample, by 1815 the stocks along the coast of Virginia, the Carolinas, and Georgia were seriously depleted, and it became necessary to send schooners to the Gulf Coast. The Navy, which was early to recognize that sea power depended on timber supplies, had secured the reservation of two islands off the Georgia coast under a law of 1799, at the same time that the sites for the navy yards were purchased, for it was feared that foreign governments, merchant ship constructors, and planters would soon cut the limited stocks available.[47] In pursuance of this important conservation policy, naval reserves were established in Louisiana in 1817, and in Florida after the annexation in 1819. Despite these precautions, however, there was extensive illegal cutting by speculators, agents of foreign governments, and squatters.[48] A survey made in 1832 showed a serious condition, there being counted on government land in accessible locations 144,655 trees of ship-timber size, which were sufficient to construct, it was estimated, approximately three hundred first-class frigates.[49] An incomplete count of timber on private lands showed 8985 trees. These supplies would have been inadequate to support the continued construction of wooden warships and high-grade merchant ships in large volume.

Thus a condition which threatened American naval expansion existed, but by the time the American government was ready to enter the competition for naval power, live oak had been superseded by steel both at home and abroad. Meanwhile it had ceased to be of much importance to the merchant marine because of

[46] Historical Statement on Live Oak, p. 199.

[47] Franklin D. Roosevelt, "Our First Frigates, Some Unpublished Facts About Their Construction," *Transactions of the Society of Naval Architects and Marine Engineers* (New York), XXII (1914), 147. (Hereafter these transactions are cited as *Trans. S.N.A. & M.E.*)

[48] Jenks Cameron, *The Development of Governmental Forest Control in the United States* (1928), pp. 33–41.

[49] Historical Statement on Live Oak, pp. 192, 198–200. The average tree yielded about 50 cubic feet of timber, and a large frigate required about 23,000 cubic feet. A ship-of-the-line required 34,000 cubic feet, and a sloop-of-war 8,000 cubic feet.

the high cost of cutting it and delivering it at northern shipyards. Indeed, in 1832, the cost of live oak frame timbers delivered in northern navy yards ranged between $1.20 and $1.50 per cubic foot, depending on size, whereas white oak timbers cost about 40 cents per cubic foot. This ratio seems to have remained practically constant, for the New York prices for frame timber in 1867 were $1.75 for live oak pieces, 85 cents for curved white oak pieces, and 48 cents for straight white oak pieces.[50] Thus, throughout the history of the building of wooden ships in America, live oak, although the best frame timber in the world, remained costly and uneconomical, and was used only in high-grade ships.

Unlike live oak, the other frame timbers used by United States shipbuilders were products of the shipbuilding region. They were, therefore, employed whenever a shortage of white oak made substitution profitable. On the whole, this was not done on an extensive scale prior to 1850, but in the next half century, it became a common practice.

There were several of these woods, and they were used in numerous combinations. A timber widely used for futtocks and floors in the highest class of vessels was the locust, which was the heaviest and strongest wood for its bulk used in the United States.[51] The superb Boston–Liverpool liner, *Ocean Monarch*, was mainly constructed of live oak and locust, a combination which gave remarkable strength and durability.[52] Usually, however, locust was substituted for the costly live oak in the floors, and the other futtocks continued to be of white oak.[53] The use of locust passed with the decline of maritime prosperity after 1857. Another timber commonly used, either in the top futtocks or throughout the frame, especially in New York, Connecticut, and Rhode Island, was the white-heart chestnut, which reached large size, was extremely light, weighing but thirty-six pounds per cubic foot, and was fairly durable if carefully seasoned.[54] In eastern New England, and especially in Maine, builders resorted extensively to the so-called hardwoods, namely, rock maple, beech, and birch, which were usually plentiful, and to hackma-

[50] Bates, "Ship Timber," p. 489.
[51] Bates, "Ship Timber," p. 479.
[52] Hall Report, p. 89.
[53] Albion, *Square-Riggers on Schedule*, Appendix IV.
[54] Hall Report, pp. 113, 115, 247.

tack. These timbers were inferior in every way to white oak, and were never placed in first-class ships, but many of the tramp ships and schooners, which were built in great numbers in this region, had some of these woods put in them for the sake of economy. Numerous combinations were devised, the most common being oak for the keel, stem, and sternpost, a hardwood for the floors, where this timber was least liable to decay, and hackmatack for the top timbers. Ash, a strong, tough, elastic wood, procurable in moderate quantities and straight pieces, was occasionally used for top timbers, stanchions, and light spars.[55] Another timber which was frequently used both for planking and frames was the red cedar, a highly durable wood weighing but thirty-five pounds per cubic foot. It was extensively used in the Chesapeake Bay region and Bermuda during the colonial period,[56] but insufficient size and strength and an insufficient quantity prevented it from becoming a major ship timber during the era of maritime expansion.

Two other woods which were of importance were the spruce of northern Maine and Canada and the Douglas fir of the West Coast. The former was generally despised by American shipbuilders,[57] and ranks among the lowest classifications of Lloyd's Register,[58] but it was sometimes employed in the great schooners built in eastern Maine toward the close of the century. It was frequently employed, in conjunction with hardwoods, in the "softwood" ships built in the maritime provinces of Canada, where white oak was scarce and poorly developed. Many of these ships decayed within five or six years, but those which were constructed of carefully chosen, well seasoned stock, and were copper-fastened, well salted, and well kept took the highest rates, 12 or 14 years A1, at both Lloyd's and the Bureau Veritas.[59] On the other hand, the Douglas fir, which was plentiful in Washington and Oregon, was not deemed sufficiently durable until it

[55] Briggs, p. 234. An example is the whaling ship *Pacific*, 314 tons, which had a frame of white oak and ash.

[56] H. I. Chapelle, *The Baltimore Clipper, Its Origin and Development* (1930), p. 9.

[57] Lynch Report, pp. 19, 97.

[58] Lloyd's Register of Shipping, *Rules and Regulations for the Classification of Wood Vessels* (1920), Table A.

[59] F. W. Wallace, *Wooden Ships and Iron Men, The Story of the Square-Rigged Merchant Marine of British North America* (1921), pp. 27–29, 309; Lynch Report, pp. 228–229.

was discovered in the middle 'seventies that winter-cutting, seasoning, and salting greatly improved it in this respect.[60] Although still considered by Lloyd's Register to be a low-grade timber, it was the basis of a considerable amount of ship construction until the close of the World War.

The rich resources of the United States in frame timber were the foundation of the comparative advantage possessed by the American shipbuilding industry during the age of wooden ships. At the opening of the nineteenth century, these resources were excellent in quality and abundant. It was also significant that the best grades of timber, with the exception of the live oak, were ubiquitous in the coastal region of the northeast, where general economic conditions were such that shipbuilding, navigation, fishing, and trade were favored employments. The "timber mining" of the ensuing century, however, led to a serious diminution in the quality and quantity of the remaining supplies, especially those suitable for large vessels. The resulting pressure caused the abandonment of conservatism and the analysis of many timbers for their shipbuilding properties, both in the United States and abroad. Lloyd's Register by 1920 was able to list a large number of tropical woods which were considered to be superior to American white oak.

In most cases, these discoveries came too late to be significant, but it should be noted that the high cost of cutting and shipping tropical timber would have restricted the use of these woods in American shipyards as long as satisfactory northern timber was available. Furthermore, the difficulties of establishing shipyards and a skilled labor supply in the tropics were very great. Although the mahogany of Honduras, the sabicu of Cuba, the morra of Trinidad, and the greenheart of Guiana were all valuable timbers which were used by the Spaniards in naval construction at Havana as early as colonial times, and were occasionally sent to Europe,[61] the shores of the Caribbean never became a center of merchant-ship construction. They might, however, have become a source of ships and timber if iron and steel had not been introduced. Difficulties in maintaining a skilled labor supply also retarded the rise of shipbuilding in the southern states, despite

[60] Hall Report, pp. 248–249.

[61] Albion, *Forests and Sea Power*, pp. 36–38. The author cites Artinano, *Arquitectura Naval Española* (en Madera), p. 78.

the proximity of the live oak and southern pine.[62] An effort to remove a Maine shipyard to South Carolina in 1876 was a failure. Hence, despite the existence of enormous tropical forests, the white oak and other northern woods constituted the primary supply of ship timber for builders both in the United States and in Europe.

6

It remains to discuss the two other types of timber which were important in wooden ship construction, namely planking and spars. These timbers exerted a comparatively minor influence on localization because of their relatively small weight, their regular shape, and the relative cheapness of their transportation. Although the frame timbers for big ships were heavy, large, and bulky, and to some extent were selected by the builders prior to cutting, planking could be cut freely, sent to the mill, and shipped coastwise by schooner. Small spars could likewise be readily secured. The cutting and shipping of masts for ships of 1000 tons and up, however, was somewhat more difficult.

There were two types of planking, namely that used on the bottom and sides of the hull and for the ceiling in the hold, and that used for decks. For the bottom and sides, builders required a wood which was strong, easy to bend, resistant to dry rot and worms, and able to stand up without loosening under heat and cold, hot sun and water. For the deck, which was exposed to the hot sun and to the wear of the ship's work, but was not particularly subject to worms and dry rot, a different material could be used.

The two woods most commonly employed for the outside planking and ceiling were white oak and southern hard pine. The former was generally used in warships and merchant vessels until the supply began to diminish in the 'thirties. It was considered superior to every other domestic wood, especially for the planking below the waterline.[63] Live oak was too heavy and too difficult to bend to be used for this purpose. The teak of India, the most durable ship timber of the world, never compared favorably in price with the American woods and hence was not extensively employed, although large quantities were used in European ship-

[62] *Report on the Advisability of Establishing a Navy Yard at Charleston, S. C.* (1836), Senate Doc. no. 360, 24 Cong., 1 Sess., p. 23.

[63] Bates, "Ship Timber," p. 475.

yards. Thus American merchant ships were generally framed and planked with local white oak during the two centuries following the establishment of shipbuilding in this continent. It is interesting to note that some big live-oak ships were replanked from one to three times with white oak during their careers. When oak became somewhat scarce, the shipbuilders found a more economical supply in the southern pine, a tall, straight tree which grew in a strip of dense forest about a hundred miles deep along the southeastern coast. Although a newcomer among the shipbuilding timbers, not having been accepted by the British Navy Board before 1804,[64] it was soon shown to be as durable as white oak if properly seasoned. The length of the plank which could be cut, which was often sixty feet or more, also enabled the strength of the ship to be increased by reducing the number of butts. Cargoes of southern hard pine began to appear in various northern yards between 1830 and 1850, and by the latter date it had practically supplanted oak.

For deck planking white pine was a prime favorite because of its lightness, ability to withstand the sun and weather, and cheapness. When properly seasoned it was normally as durable as the other planking in the ship. It was also extensively used in the deckhouses and cabins in ordinary vessels, but mahogany and teak were often used for this purpose in high-class ships.

The ample supply of great white pine masts which American shipbuilders found close at hand proved to be a very valuable resource while it lasted. For vessels of small and moderate size the masts, yards, and bowsprits were rarely difficult to secure, but a shortage of spars for ships of the largest size developed early in the nineteenth century. As early as the seventeenth century, the British Navy had found it necessary to secure the masts for its ships-of-the-line from the white pine of New England. Such spars were tremendous, the mainmast of a 120-gun ship being approximately 120 feet in length, 40 inches in diameter and 18 tons in weight. For such masts it was necessary to secure a perfect tree of an age of a century or more. Such trees were difficult to secure in Europe as early as the Dutch Wars. Accordingly, beginning with the first settlements in New England, mast timber was cut for shipment to British and continental shipyards. The resulting rapid depletion of the American forests

[64] Albion, *Forests and Sea Power*, p. 34.

induced the British government to establish in 1729 the first conservation policy in North America, under which trees of mast size were reserved for the Royal Navy. After the Revolution, the size of the masts required by the then predominantly-small American merchant ships created no great problem, but the development of the great clipper ships in the 'fifties and of the larger grain ships of the post-Civil War era again brought on an acute shortage. These ships required masts and yards as long as those of a battleship, which by then were difficult to secure in the East. Despite the growing shortage, however, the United States shipbuilders had a notable advantage over those of Europe prior to the use of iron masts because they could secure great masts and spars at relatively low cost.

The five requirements of a good spar timber were strength, length, light weight, durability, and a suppleness which would enable the spar to bend in squalls without breaking. Great care was necessary in the selection of these spars, for the safety of the ship and the success of the voyage depended upon the proper functioning of the rig. Until the Civil War, the primary wood used for large masts and spars by American shipbuilders was the white pine, or *Pinus Strobus*, which possessed these qualities to a high degree, and grew from the Maritime Provinces southward to Pennsylvania and thence along the Allegheny Mountains to Georgia, and reached its highest perfection in the shipbuilding regions of Maine and New Hampshire. Spruce was also used for small spars. The white pine reached a great size, the full-grown trunk being from 100 to 150 feet in height and from 35 to 42 inches in diameter.[65] These full-grown trees were two hundred years or more in age, and hence were difficult to replace. Fires and lumbering rapidly reduced the supply, with the result that in many places it was necessary to go far up the rivers and some distance overland to secure great masts. By 1862 great masts had become scarce even in Maine,[66] and by 1880 it was difficult to secure the smaller masts for the two- and three-masted schooners. Since great masts were extremely heavy and expensive to haul overland, the depletion of the local mast supplies seriously decreased the comparative advantage of the American shipyards.

[65] Gifford Pinchot and H. S. Graves, *The White Pine* (1896), pp. 4–5; R. G. Wood, *A History of Lumbering in Maine* (1935), p. 21.

[66] Wood, p. 21.

With the close of the Civil War, a search began for substitute mast timber. White pine masts were occasionally secured by rail from Canada, Michigan, or other interior points. It usually proved to be cheaper, however, to use the southern hard pine, which was considerably smaller in height and diameter than white pine [67] but was otherwise satisfactory. In the case of large ships, built-up masts, containing three or more pieces, were frequently constructed. After 1880, however, square-rigged ships and great schooners were usually masted with the Oregon pine, or *Pseudotsuga Douglasii*, which was secured on the Northwest Coast and was shipped by rail or sailing vessel to the eastern yards. This tree, which often exceeded 250 feet in height, was able to provide for these ships the huge lower masts, which sometimes exceeded 120 feet in length. The transportation of these masts was costly, however, and this was one cause of the rise of shipbuilding on the Pacific Coast.

Iron masts were rarely placed in American ships, owing to the lack of facilities for their construction in the shipyards. In Europe, however, the small size of the principal spar timber, the fir, or *Pinus Sylvestris*, which was mainly secured along the southern shore of the Baltic,[68] and the growing difficulties in securing American pine caused the extensive use, beginning in the late 'fifties, of metal masts and wire rigging.[69] These spars proved to be stronger, lighter, and cheaper than wooden ones, and released British designers from dependence on a dwindling supply of mast timber.[70]

7

During the course of the nineteenth century, the costs of securing suitable timber for wooden ships steadily increased. In the early part, builders could secure white oak frames and planking and white pine masts close at hand in the forests then covering the eastern seaboard. In contrast, in the latter part of the century, it was necessary to cut timber in many distant places — the

[67] C. S. Sargent, *The Woods of the United States* (1885). The southern pine reached a height of from 60 to 95 feet and a diameter of from 24 to 48 inches.

[68] Albion, *Forests and Sea Power*, pp. 30–31.

[69] E. J. Reed, *Shipbuilding in Iron and Steel, A Practical Treatise* (1869), p. 259.

[70] Charles Lamport, "On the Construction and Support of Iron and Other Masts and Spars," *Transactions of the Institution of Naval Architects*, London, IV (1863), pp. 124–129. (Hereafter these transactions are cited as *Trans. I.N.A.*)

oak pieces in the mid-west, the hardwood pieces in the interior of New England, the knees in Canada, the planking in Georgia and the Carolinas, and the masts in Oregon, Washington, and the South. Some ships were then built with scarcely a piece of local timber. Serious restrictions were also placed on designers by the exhaustion of the virgin forests, for owners of timber lands rarely allowed the second growth to approach more than one-half or two-thirds of the mature size, owing to the risk of loss, lack of foresight, and the desire to secure cash. Hence the economic foundation of the shipbuilding industry was unstable.

During the seventeenth and eighteenth centuries, and in some areas during the first half of the nineteenth century, the costs of securing timber were extremely low because of the use of oak and pine which was secured within easy hauling or rafting distance of the shipyards. Shipbuilders rarely stocked much timber because of the irregularity of operations and the variation in sizes and designs of vessels. Instead, on receiving orders or deciding to build on their own account, they went into the country and cut or ordered their material from farmers. Many, especially those operating small yards in rural sections, preferred to cut their timber themselves and to secure the resulting profit.[71] The shipbuilding process was, therefore, almost completely integrated, despite the small size of the firms. In Maine, where shipbuilding and lumbering were closely allied, timber was frequently secured on the builder's own lands. These expeditions, which sometimes lasted as long as six weeks, were usually undertaken in the winter, when the sap was out of the wood and the snow facilitated hauling. In this way, it was possible to select frame timbers of the proper sizes and shapes for the proposed ship, and if the haul was long they could be rough-hewn on the spot, thus reducing the weight to be moved. The vessel could then be laid down in the yard, and was usually finished by late spring or summer. This "timber cruising" by builders was common in New England generally during the first quarter of the century, and continued in Maine until after the Civil War.[72]

In addition, a large part of the supply was provided by farmers who supplemented a meager income by cutting a certain amount of ship timber on their woodlots in the late fall and winter. In

[71] W. H. Rowe, *Old Shipbuilding Days on Casco Bay* (1929), p. 61.
[72] Bates, "Ship Timber," p. 482.

many shipbuilding towns the early morning arrival of huge teams, or sleds drawn by from two to ten yoke of oxen, and loaded with oak, maple, beech, and hackmatack frame timbers, knees, or white pine masts was a common winter spectacle. Sometimes master builders marked desirable trees, but usually the farmers, who came from distances up to twenty or thirty miles, relied on the demand which was known to exist in active centers. A knowledge of the shapes and sizes required by the builders was particularly valuable.

The timber destined for use as keels, keelsons, floors, futtocks, and beams, known as *piece timber*, was measured in the yard for cubic volume, and payment was made according to the size and shape, scarce pieces bringing higher prices. Planking was delivered either cut to the proper thickness but left rough on the edges to be fitted, when it was known as *plank stock*, or cut and dressed on all four sides, when it was known as *plank*. Rough logs were also often delivered, and were sawn into plank in the yard. Knees, of which some were cut from crotches and others were dug up and cut from roots, required special care, and the large sizes usually brought substantial premiums. Woodsmen took great pains to secure the maximum number of desirable pieces from each tree.

By 1830, it had become necessary for the shipbuilders in the larger centers, chiefly Boston, New York, Philadelphia, and Baltimore, to secure supplies from more distant sources. New York builders secured them from the upper Hudson and from the western part of New York State by way of the Erie Canal. Boston builders drew on New Hampshire by way of the Merrimack Canal and on the West by means of coasting vessel from New York. Accordingly merchants specializing in ship timber arose. These men employed "timber-cruisers" to seek out supplies of suitable frame and mast trees, and sometimes owned sawmills and timber limits. For instance, the East Boston Timber Company, formed in 1834, acquired timber lands and a mill on the Niagara River and a large depot at Boston.[73] The maintenance of stocks was only profitable in the large ports, however, and the majority of builders relied on timber contractors, who agreed to cut, haul, and ship the desired pieces to the shipyard. These men, who were usually experienced ship constructors, were generally furnished

[73] W. H. Sumner, *History of East Boston* (1858), pp. 670–671, 690.

by the master builder with plans or a set of light battens, or molds, which enabled the shape of each piece to be determined. The timbers would often then be rough-hewn to within an inch or so of the given dimensions, and numbered. The reduction in weight so achieved lowered the cost of transportation.

The cutting of live oak presented special problems to the contractors and merchants who procured the supply because of the dispersion of the trees among the hammocks, the marshy ground, the weight of the wood, and the fact that it would not float. Cutting was usually done in the spring, when the increased flow of water enabled flat boats to be hauled inland.[74] Trees were carefully selected and the pieces were rough-hewn on the spot, after which they were laboriously hauled to the nearest waterway. The final step was to ship the timber to the yard by schooner. The contractors were generally shipbuilders or naval constructors who were familiar with the needs of the yards and usually supplied their own men and equipment.[75] The cost of cutting and shipping normally amounted to from 60 to 90 per cent of the price of the timber at the yard. Delivery required from one to two years, depending on the size and amount of the timber desired. Hence northern builders found live oak a costly and inconvenient wood to use.

The masts and important spars for large vessels, which usually weighed from five to fifteen tons, were among the heaviest single pieces required; hence great care was necessary in the selection and hauling of the tree in order to avoid damage. The cutting was undertaken by shipbuilders, contractors, and lumbermen. This was usually done in winter, when snow and ice facilitated hauling. Needless to say, careful handling was necessary to avoid disaster on steep grades. Lumbermen working in the pine forests of Maine and the other northern states produced the bulk of the spar timber during the nineteenth century. The logs were floated down the numerous rivers in the spring thaw and were delivered to the local builders and spar yards or shipped coastwise by schooner to other ports. Since a knowledge of shipbuilding was not necessary for the cutting of masts, specialized firms did not appear in this branch of the business.

[74] Statement of John Rodgers, President of the Navy Board, *Annual Report of the Secretary of the Navy, 1818*, Senate Doc. no. 94, 15 Cong., 1 Sess., p. 11.
[75] See P. McC. Reed, *History of Bath, Maine* (1894), p. 145.

CHAPTER IV

THE ORGANIZATION AND TECHNICAL METHODS OF THE INDUSTRY OF BUILDING WOODEN SHIPS

I

THIS SHIP TIMBER was hauled and floated to the countless small shipyards which dotted every bay, river, and creek from Passamaquoddy Bay to Norfolk, and which were well-adapted to construct cheaply the hundreds of small vessels which were employed in the American marine. This industry was essentially a handicraft, easily entered by capable and enterprising young men. Prior to the Civil War, the typical enterprise was the small-scale proprietorship or partnership controlled and managed by a working master carpenter, although after about 1840 some firms achieved considerable size. In every respect, conditions were highly favorable for the active prosecution of the business. Waterfront sites were abundant all along the coast, and timber lay close at hand. Little capital and fixed plant were necessary. No serious obstacles hindered the acquirement of skill and the entry of young men into the business. Accordingly, there developed a highly-competitive industry, which probably comprised, during the years of its greatest development in the 'fifties, over a thousand firms. Ship prices were consequently determined under conditions of competition, and therefore bore a close relation to the cost of production. It is significant that few fortunes were made in shipbuilding comparable to those achieved in commerce. Only the particularly gifted builders left their mark in this respect. Thus the industry of building wooden ships in the United States, and in Europe as well, was a small-scale handicraft business, a type commonly found in the early period of capitalism.

At the head of the simple organization found early in the nineteenth century was the master carpenter, who designed the ship, made the model, selected the timber, supervised construction, and attended to financial matters. Frequently he also owned the shipyard and provided the capital. He might even become the owner of the ship if he built on speculation. To help him, he might

employ from one to fifty workmen, depending on the size and number of the vessels under construction.

With the development of larger yards after 1840, larger organizations arose, and dependence on capital and capitalists grew. After the Civil War, the master builder frequently became a hired foreman working for capitalist owners. Later, in the industry of building steel ships, the corporate form displaced all others, and the industry became dominated by huge firms.

The master carpenters fall into a number of categories. First, a large number who possessed capital, ability, and reputation operated comparatively large well-equipped yards more or less continuously. Second, there were others who built ships only occasionally, as opportunities offered, and engaged in other occupations, such as shipping, farming, lumbering, and building construction at other times. A few of these moved about building ships on contract for owners in various ports. Others took crews of men with them and built vessels in places where timber supplies could be had especially cheap. For instance, Noah Brooks and Samuel Hall of Scituate, who were later to become famous builders, took men into eastern Maine on occasion and built vessels there.[1] Sometimes young men who had just completed their apprenticeship toured the coast, working as journeymen and occasionally as master carpenters. An important Medford builder, Calvin Turner, appears as a builder at Pembroke, Ipswich, Charlestown, and Kennebunkport.[2] Third, there were some captains, fishermen, and lumbermen who built vessels for their own use. Thus it appears that there were many gradations in economic status among the shipbuilding firms.

There was considerable variation among the established yards. At one extreme were the large city establishments, many of which specialized in the construction of Indiamen, packets, clippers, and other high-grade vessels. In such yards the construction of from two to five large ships could be undertaken simultaneously, and the number of employees reached two hundred at times, although such a figure was comparatively rare. Shops, mold lofts, ship houses, and sawmills were often provided to facilitate the work. It was not uncommon during the nineteenth century for a

[1] Briggs, pp. 356–357, 381.

[2] Briggs, pp. 174–175; S. E. Bryant, *List of Vessels Built at Kennebunkport from 1800 to 1874* (1874); Boston Registers and Enrollments, 1805–1824.

leading master builder to construct as many as a hundred ships in such a yard during his career. Many, such as Adam and Noah Brown, Christian Bergh, Henry Eckford, and William H. Webb of New York, Thatcher Magoun and Galen James of Medford, Samuel Hall and Donald McKay of Boston, and George Raynes of Portsmouth, achieved national fame as designers and constructors. These firms stood foremost in the industry.

At the other extreme were the small establishments, located primarily in the outports, which constructed most of the freighters, coasters, and fishing vessels. Often these yards possessed but one building berth, and often that was used irregularly. The plant might consist of no more than a graded launching place and a set of bed logs and ways. The output of such a yard was commonly one or two vessels a year, some of which might be small schooners and sloops. The number of employees might be as small as five or ten, and rarely exceeded twenty-five.

Between these two types were a large number of city and country yards which built several merchant ships yearly, yet do not deserve to be ranked with the leading firms. Apparently there were important diseconomies in the operation of large establishments, which only men of exceptional genius could overcome. This is not surprising, for careful attention to detail was necessary in design and construction work, and the advantages of large-scale operations were few. The scale of operations was thus comparatively small.

Prior to the Civil War, the shipyards remained remarkably free from control by moneyed interests and from consolidations. Although wealthy shipowners occasionally hired master carpenters to construct ships on their own property, the working master was able to maintain his independence. Neither did small masters come under the domination of large ones. This suggests that conditions were basically favorable to the small firm at this time. Since a small 200-gross-ton, deep-sea ship rarely cost over $15,000, financial assistance usually could be secured, if necessary, from the owners or bankers. Three primary factors governing success in this business were the diligence, supervision, and professional skill of the master. Hence nearly all of the successful yards of this period were owned individually by men who were actively engaged in construction. Builders frequently took a share amounting to between an eighth and a quarter in the ships which they

built, which share they might hold permanently or sell as soon as possible. There was thus a close tie with the shipping industry in a number of ways, but there is no evidence that shows any subordination to it.

After 1840, however, the problems created by the increasing size and cost of vessels caused a substitution of partnerships for proprietorships on an extensive scale, and an increase of the capital of many firms. In some yards, such as those of Sprague & James at Medford and Smith & Dimon at New York, it proved to be desirable to establish one partner as the business manager and the other as the naval architect and constructor. Partnerships became common among the city yards engaged in building large and costly ships at an earlier date than in the industry as a whole. A few ill-fated corporate yards arose in the 'fifties. Even these enlarged firms were, however, extremely small, judged by later standards.

Another indication of the advantages of the small firm was the large amount of occasional construction by builders before 1840. No figures are available, but it may be estimated that from 10 to 20 per cent of the output came from the yards of occasional builders prior to 1840. Indeed, an expansion in output normally resulted in an increase in the number of builders, rather than in a substantial increase in construction in existing yards. The reverse reaction occurred in contraction. Some builders often failed to construct vessels for several years, and others only appear once or twice in the customs-house records.[3] Some of these were foremen, shipwrights, or apprentices just out of their training who secured occasional contracts or infrequently built on speculation when prices were high. Others moved about to secure the advantages of new timber supplies.[4] In a few cases farmers constructed deep-sea ships on their lands and hauled them laboriously by means of oxen to the water in winter, the entire process sometimes taking four or five years.[5] Such occasional shipbuilders

[3] Many such instances appear in the records of the Boston, Portsmouth, and Kennebunkport customs houses. For instance, at Boston between 1815 and 1824 among the builders of full-rigged ships the name of James Ford appears twice and that of Adam Perry once.

[4] Briggs, p. 381.

[5] Jeremy Belknap, *History of New Hampshire*, 3 vols. (1784–1792), III, 209; Briggs, p. 212. For instance, Thomas Rogers of Marshfield occasionally built small vessels in his farmyard.

required little more than a set of shipways, some hand tools, and a knowledge of construction which could be secured by several years' work in a shipyard. Entry into the industry was therefore easy, and a rapid response occurred whenever sufficient inducement offered. Given sufficient motivation, shipyards readily appeared at suitable sites, both in the seaports, where as many as ten or twenty yards sometimes lined the shore, and on the shores of the innumerable coves and creeks in the rural areas.

The shipbuilding plant was usually of the simplest type. A suitable launching place, which had to be firm, dry, and possessed of sufficient room and depth of water off the ends of the shipways, was the primary requirement. A ten-foot depth at high tide from the ways to the open sea, and sufficient room to swing a 100-foot ship around the bends of a stream were for many years the minimum requirements. By the 'fifties, however, many builders of wooden vessels required considerably more room, the minimum draft of large, first-class vessels then being twelve feet. Vessels were built on valueless beaches, on river banks, and at the turns of the many small creeks indenting the coastline. Sometimes a moderate amount of dredging, digging, and filling was necessary. Elsewhere river works had to be provided. It was necessary at Kennebunk, for instance, to install a lock costing $6000 in order to get ships down the narrow, winding stream.[6] Valuable city water-front land was rarely used, and the growth of the ports frequently forced the shipyards to move. Builders also sought the cheap lands at the heads of the many streams in rural areas in order to secure better access to the oak and pine supply.

Every yard required one or more shipways, which consisted of wide pine boards firmly placed on bed logs in the manner of a railroad track, and a dock where vessels could lie while outfitting. The latter were sometimes substantial structures of stone or timber reaching deep water,[7] but often they were much less pretentious, the hulls resting on the mud at low tide. The most important private firms and navy yards frequently had ship houses, which were huge sheds designed to protect vessels from

[6] A. J. Coolidge and J. B. Mansfield, *A History and Description of New England* (1859), I, 175.

[7] See for example the description of the wharf of James Marsh of Charleston, S. C., a shipbuilder, in *Report on Establishing a Navy Yard at Charleston, S. C.* (1836), Senate Doc. no. 360, 24 Cong., 1 Sess., p. 35.

the injurious effects of sun, rain, and snow, and to secure greater regularity and speed of construction. These were huge structures. The one at Thatcher Magoun's yard at Medford was 100 feet high, and covered two berths.[8] At the Philadelphia Navy Yard the first house, built in 1821, had a length of 210 feet, and the second, a length of 270 feet.[9] Only builders of high-class ships could afford this luxury, however.[10] A few yards also had steam sawmills in which plank was cut.[11] Later, after the development of new saws, frames were also cut in such mills, which became more and more common. In most yards, however, sawing and cutting were done by hand, and the amount of fixed equipment was small.

The marine railways, which were the chief means of docking vessels for repairs, cleaning, and coppering during the age of wooden ships, were of considerable importance. In 1823, Commodore Rodgers complained that the then common careening method, by which vessels were rolled over on their sides by means of heavy tackles stretched taut from the mastheads to a wharf at low tide,[12] was tedious, expensive, dangerous, and injurious, especially to the hulls of large vessels.[13] The practice of grounding ships on sandy beaches was little more satisfactory. Accordingly, during the first half of the century, American vessels were frequently docked for repairs or coppering abroad.[14] In many ports, however, marine railways appeared, which consisted of large cradles hauled by horses or steam-driven windlasses. The first was built at Salem about 1824.[15] Others followed at New York (1826),[16] Bath (1832),[17] Portsmouth, New Hampshire (about 1836), and other shipbuilding and repairing centers. Be-

[8] French, p. 8.

[9] J. T. Scharf and T. Westcott, *History of Philadelphia*, 3 vols. (1884), III, 2340.

[10] For instance the Black Ball liner *James Munroe* was built in the shiphouse of A. N. Brown at New York; see C. P. Wright, "The Origin and Early Years of the Trans-Atlantic Packet Lines of New York, 1817–1835" (manuscript thesis, 1932, Harvard College Library), p. 62.

[11] There was a sawmill in the well-equipped Brown Yard at New York as early as 1824. See J. H. Morrison, *History of New York Shipyards* (1909), pp. 54–55.

[12] C. H. Haswell, U.S.N., "Reminiscences of Early Steam Navigation in the U. S. A., 1807–1850," 2 pts., *Trans. I. N. A.*, XL–XLI (1898–1899), pt. II, p. 90.

[13] J. H. Morrison, *New York Shipyards*, p. 53.

[14] J. H. Morrison, *New York Shipyards*, p. 51.

[15] Hall Report, p. 109.

[16] J. H. Morrison, *New York Shipyards*, p. 51.

[17] L. P. Lermont, *Historical Dates of Bath* (1874), p. 64.

fore the Civil War these railways were usually operated by independent corporations, which merely hauled the ship and charged a fixed rate per day for the use of the equipment, the repair work being done by shipbuilding contractors; but occasionally they were the property of individual yards.[18]

2

A very simple division of labor existed in the early American shipyards because of the nature of the business. Although it was possible for three or four men to construct a full-rigged ship in the course of time, from eight to twenty-five men were usually employed on such a vessel. With the increase in vessel sizes during the middle years of the century, however, the number slowly increased up to a maximum of approximately fifty by the close of the century. In the city yards, where there was fairly regular employment, a considerable division of labor soon developed. The shipwrights were frequently divided into specialized groups, chief among which were the hewers, who shaped the timbers with adzes, the sawyers, who cut frame timber and plank in sawpits, the dubbers, who faired the outside edges of the frames before the planking was placed, the borers, who drilled the holes for the fastenings, the liners, who marked the shape and position of each plank, the trunnelers, who made the fastenings, the fasteners, who drove home and wedged the fastenings by means of heavy mauls, and the joiners, who planed and smoothed the outside and inside of the vessel. In addition, there were the caulkers, who caulked the seams and paved the decks with pitch, the sparmakers, and the smiths, as well as men to carry and sort timber and plank. A large yard might have a number of men in each craft more or less permanently attached to it, but in the small yards, especially those in the country, a workman was expected to perform all or many of the operations. As late as 1830, ship carpenters in New York were expected to do any work to which they might be put.[19] It is significant, perhaps, that in an industrial parade at Portsmouth, in 1778, only the shipwrights, caulkers, joiners, spar-makers, riggers, blockmakers, ropemakers, and gravers had positions as separate crafts.[20] In a similar parade

[18] This was true for example at Portland, Maine. See Rowe, p. 61.
[19] J. H. Morrison, *New York Shipyards*, p. 93.
[20] Nathaniel Adams, *Annals of Portsmouth, N. H.* (1825), p. 291.

in 1851 the same division appeared. In the United States Navy Yards during the first quarter of the nineteenth century, only ship carpenters, sawyers, caulkers and joiners were listed as specialized workmen.[21] Frequently certain operations, such as the making of the figureheads, scroll work, knees, spars, boats, blocks, and pumps, were let out to special contractors, who might be successively employed by various builders in the area, or might even seek work in more distant centers on occasion. After the Civil War, the contracting system was extended to include nearly all of the operations. On the whole, shipyard organizations can scarcely be called complex at this time.

The nature of the labor supply varied considerably from place to place. In New York and some of the other cities skill was highly prized, and during much of the period it was possible to enforce reasonably strict rules regarding apprenticeship and skill. The quality of the work was therefore excellent, but the limitation of the supply of labor and the comparatively high living costs of this wage-earning group caused wage rates to be relatively high in the cities. In the rural areas, in contrast, only a small number of workmen were regularly apprenticed, the majority having learned their craft as helpers. In Maine and other eastern areas, a considerable number of men came from the local farms, especially in the winter when farm work was light.[22] Accordingly, labor was cheaper, although less skilled, and the supply was more flexible than in the cities. Wage differences, therefore, appeared between many ports because of the immobility of the country labor supply and variations in living costs.

Work in an American yard was comparatively arduous, judged by modern standards. The hours of work at the beginning of the century were from sunrise to sunset, both in winter and summer, and sometimes the day was as long as twelve hours.[23] Although a ten-hour day was secured in most of the large ports between 1830 and 1860, the older schedule was continued in Maine until the close of the century. Before the Civil War, grog, which was usually billed as an extra to the owners, was commonly

[21] *Report of the Secretary of the Navy Giving Detailed Information of the Expense of Building Each Vessel of War* (1823), Senate Doc. no. 12, 17 Cong., 2 Sess.

[22] P. McC. Reed, p. 147.

[23] J. H. Morrison, *New York Shipyards*, p. 66; R. C. McKay, *Some Famous Sailing Ships and Their Builder, Donald McKay* (1928), p. 7.

served at 11 A.M. and 4 P.M.[24] A sensation is said to have been caused at Medford in 1817 when the ship *Falcon* was built and launched without the aid of rum.[25] Labor relations appear normally to have been excellent. The masters generally worked with their men and kept the same hours. Personal friendships and a small amount of paternalism were common. Satisfactory data on wage rates is difficult to secure, but it appears that prior to 1830 they rarely exceeded $1.75 per day,[26] and frequently they were much less.[27] Ship carpenters, caulkers, and joiners received the highest rates. Payment was usually in cash, but in some cases store pay was provided [28] because the ship-owners had made a barter-deal with the builders, because of the convenience of the arrangement to the workers,[29] or because of the opportunities for profit thus made available to unscrupulous builders.

Effective labor organization was practically unknown in most shipbuilding centers throughout the period. A number of benefit societies appeared in the large ports at an early date, the first probably being the Journeymen Shipwrights Society of New York, which was founded in 1804.[30] By 1830, however, the unions were sufficiently powerful in New York to strike for better conditions, and until the decline of the New York yards after 1857 unionism was an important factor in restricting the labor supply and raising costs. Outside of the large cities, however, unions were rare and weak.

Shipbuilding, like farming, was in fact a way of life in many towns. It was actively prosecuted when demand was good, and in bad times the workmen supported themselves in other ways. In most cases, the relationship between the master and his men was close and personal, and hence friction and rigidities in industrial relations were rare. Opportunities were numerous and the ladder

[24] Briggs, pp. 93, 103, 236.

[25] Charles Brooks, *History of Medford* (1855), p. 363.

[26] The rates for men working on battleships in the Navy Yards ranged between $1.50 and $1.75 per day. See *Report on Expense of Building Each Vessel of War* (1823).

[27] Lermont, p. 61.

[28] Lermont, p. 61.

[29] I am informed by Miss Isidore Smith of Kennebunk, the daughter of a shipbuilder, that store pay was used to protect workmen's families against the Saturday night spree. It is likely that in strong "temperance" towns this was an important consideration.

[30] J. H. Morrison, *New York Shipyards*, p. 64.

of advancement was readily climbed. On this simple foundation, the American shipbuilding industry rose to world-wide renown.

3

The bases of national economic power are the resources, labor, technique, organization, and industrial leadership of a country. The material resources are important in any case, but ability to design, construct, and organize better than others has frequently meant the difference between competitive advantage and disadvantage. This was true in shipbuilding, for the leadership of American shipbuilders in the design and construction of wooden sailing ships in the mid-nineteenth century was a major factor in the rise of the American merchant marine.

The master carpenter was the person on whom the burden of industrial leadership primarily fell. It was necessary that he be a man of many accomplishments, for he was usually responsible for the design of the ship, the selection of the timber, the details of construction, the organization of the work in the yard, and the launching of the vessel; and in addition, he had to secure contracts, sell vessels, buy supplies, and handle the accounts.[31] Design work was of particular importance, for, although naval architecture was a special profession in Europe, outside designers were rarely employed in the United States except in the construction of warships, there being perhaps but two professional designers in the country during the early part of the century — Joshua Humphreys of Philadelphia and William Hackett of Amesbury. These men were occasionally called in as special consultants and draftsmen in the building of warships or other big vessels, such as East Indiamen. Owners normally allowed builders a wide amount of discretion in design, only the general features of vessels being given in the building contracts, and, accordingly, each master fashioned his model according to his notions, which were largely based on observations and experience.[32] The responsibility for life, property, and performance were therefore great, but the rewards were substantial for those who could excel. The builder was also responsible for the scantlings and manner of construction, the laying down of the design full size in the mold

[31] For a brief account of an early American firm see H. T. Wild, "Galen James," *Medford Historical Register*, Medford, Mass., XI (1908), 73–91.

[32] Lauchlan McKay, *The Practical Shipbuilder* (1839), pp. vii–viii, 13, 47.

loft, and the subsequent selection of the proper timber to be cut. In the yard, he was frequently both leader and instructor, and needed, therefore, to be proficient in the use of the tools of the trade. Complete mastery of all branches of his craft was the primary requirement of success.

The technical methods employed by most of the shipbuilders were unscientific, and were the product of conservatism, and trial and error. Probably but few had even an acquaintance with the treatises on design and construction current in France and England. Lauchlan McKay observed in 1839 as follows:

> The shipbuilder has labored, in the larger portion of our country, under the necessity of working by guess. The publications of other countries have been large and expensive, full of intricacy, scientific rather than practical, and consequently of little use to the uneducated mechanic. Still, without any rules, our mechanics in many parts of the country have been enabled to complete many excellent vessels.[33]

Indeed, as late as 1851, J. W. Griffiths, the noted designer, was forced to complain that few vessels were built from plans and that few builders understood their use.[34]

Each master builder was guided by a developed sense of form which he first expressed in a half-model. Designs normally followed time-proven forms, and innovation was consequently slow. Some yards even had standard models of cargo vessels, which were expanded or contracted in size as required. Each builder tended to be "fettered with a shape peculiar to his notion." [35] The result was that although some notable improvements in form were made, many ships were clumsy and poorly designed. Innovations were, to a large extent, the product of a limited number of gifted and highly skilled men. The pressure of competition, however, frequently caused the early duplication of the new design in other yards.

The principal method of developing a design was by means of the lift model, which consisted of smooth boards built up in layers and so arranged as to be readily taken apart, and which was shaped by the designer in his shop until it represented the form of one side of the vessel. Since the lifts could be taken apart, it was possible to secure offsets for each waterline, and from

[33] L. McKay, p. vii.
[34] J. W. Griffiths, *Treatise on Naval Architecture* (1851), p. 34.
[35] Griffiths, p. 18.

these the shapes of the timbers could be laid out full size in the mold loft. By this method the builders were able to avoid the use of plans, and at the same time to obtain wide latitude in the shaping of the hull. Ship design was thus essentially an art which could be acquired by even a relatively uneducated man. The lift model was probably devised in the United States. It appears to have been in use before 1790, although the first ones now known were made by two leading shipbuilders, Enos Briggs of Salem and Orlando Merrill of Newburyport about 1794 and 1796 respectively.[36] During the nineteenth century, nearly all American sailing ships were constructed from such models.[37]

4

Three methods of constructing vessels were employed in American wooden-ship yards. First, the method of shaping the frames according to carefully drawn drafts and specifications, which was generally employed in Europe for all important vessels, was occasionally used by leading builders, notably the constructors of naval vessels, packets, and clipper ships, but was far from popular. Second, and at the opposite extreme, was the unscientific and dangerous method of setting up the ship by eye, which was sometimes used by untutored builders, particularly those engaged in constructing small vessels during the early part of the century.[38] Precedent was the guiding star of such builders, many of whom through long experience were able to approximate with considerable accuracy the correct shapes of the floors and futtocks of a vessel of standard model. Some even possessed one standard set of molds which they used with variations for many vessels.[39] The procedure consisted of setting up the keel, stem, sternpost, and midship section in consultation with the owner, after which the remaining frames were set up by eye, proceeding forward and aft from the midships frame. The skeleton was then faired by means of long battens, and planked. Builders using this method were

[36] C. C. Cutler, *Greyhounds of the Sea, the Story of the American Clipper Ship* (1930), pp. 28–29. Prior to 1800, scale framed and planked models and solid frame models in which cuts were made vertically at each station were sometimes used in America.

[37] L. McKay, p. 13; Griffiths, pp. 34, 90–92. McKay does describe, however, a method of building a vessel by means of body plans.

[38] C. H. Cramp, "The War Eagle" (Shipbuilding on Chesapeake Bay in the Early Nineteenth Century), *Trans. S. N. A. & M. E.*, XVI (1908), 2–3.

[39] Cramp, pp. 2–3.

highly dependent on established sizes and designs, and many consequently constructed numbers of vessels which were fairly similar. Although an inexpensive method, it rapidly became obsolete after 1830, except for the construction of small craft, because of the notable advances made in the size and model of ocean-going vessels and the need of using more accurate methods.

As has been indicated, however, the primary method of construction was by means of the lift model, which enabled the builder to fashion the vessel by eye. These models, many of which are still extant, were carved with rare skill and accuracy, the scale usually being a quarter of an inch to the foot, which gave a twenty-five inch model for a one hundred-foot vessel, and thus enabled the craftsmen to see all of the model in one glance — a desirable condition in such modeling work.[40] The lifts, which usually were alternately of light pine and dark cedar, were planed to the desired depth between waterlines. The back or centerline plane extending from bow to stern was then carefully smoothed, and the block was finally squared to correspond to the outside dimensions of the vessel, namely the length, half-breadth, and depth. The builder was then ready to proceed with the fashioning of the model, the first steps being to draw on the block the line of the deck, with its sweeping sheer, and the shape of the keel, stem, and sternpost. Then the deck could be cut into the block, and the shape of the midship section, which was usually pre-determined, cut in along the length of the block, thus establishing the amount of deadrise, the curve of the bilge, and the shape of the topsides. For most types of merchant ships these characteristics of the vessel were practically standardized. The rest of the model, however, was shaped by the builder according to his fancy.[41] The position of the midship section was usually well forward of the center of the length prior to 1850, McKay giving a rule of one third of the distance aft of the forward perpendicular. Many ships had from ten to fifteen feet of parallel body amidships. With these characteristics established, the designer finally shaped the ends, a task which required great judgment and skill of hand if the lines were to be perfectly fair. Builders took into consideration in their work the wishes of the owners, the admeasurement rules, the nature of the trade in which the ship was to be em-

[40] Griffiths, p. 115.
[41] L. McKay, pp. 13–16.

ployed, and the requirements of speed and carrying capacity. There was little scientific information available, however, and as late as 1850 David Brown, a leading New York builder, noted that "each individual modeller has little else besides his own taste and eye to guide him." [42]

The next step was to take the model apart and from the dimensions so procured to lay down the vessel full size on the floor of the mold loft, which was a large loft, usually about forty by fifty feet, commonly located in a barn or over a shop. The sheer and body plans were carefully drawn out and cut into the floor with a knife, and any lack of fairness corrected by means of long flexible battens. This operation, when completed, gave all of the essential curves and dimensions necessary for construction, and from it molds or light timber forms were made which served as patterns in the hewing of the timbers. Lofts were rarely large enough to allow the entire ship to be laid down at once, and hence the forward and after halves had to be drawn separately.[43]

In the yard the construction of the vessel required much care on the part of the master carpenter.[44] The first step was to lay on heavy keel blocks and at the proper slope the huge keel, which usually required two or three pieces scarfed together to provide sufficient length, and in large vessels was two timbers deep in order to provide adequate strength. The huge stem and sternpost were then cut and raised into position on the keel, and this operation was followed by the placing and bolting of the floor timbers at each frame station, thus outlining the bottom of the ship.

The most difficult operation consisted of the "raising" of the frames. Each frame consisted of two parallel sets of futtocks, each carefully cut to molds and beveled to receive the planking, the joints of each set being bridged by the futtocks of the other, and the whole being strongly fastened together. From three to

[42] Quoted in Griffiths, p. 93.

[43] McKay wrote in 1839, "In many of the country towns where I have been laying down and making molds, a loft of this description is not to be had, and I have been compelled to clear out a sail or rigging loft, and even then have been so pinched for room that I have been compelled to lay the after body divided in two parts." — *The Practical Shipbuilder*, p. 20.

[44] Descriptions of shipbuilding operations are to be found in the treatises of McKay and Griffiths, and also in E. C. Plummer, *Reminiscences of a Yarmouth Schoolboy* (1926).

five futtocks were used in each half frame, in addition to the floor piece, depending on the size of the ship. Each frame or half frame was fashioned on smooth ground or on a framing platform near its station. The "raising" of the vessel, which was done when a number of frames were ready, was accomplished by means of a derrick or set of shears. Usually each half frame was put into position alongside the floor separately, but in the case of large ships or lightly manned yards, the heavy first futtock, and sometimes the others as well, were placed independently — a time-consuming process. In the case of small craft the entire frame, including the floor, was assembled on the ground and hoisted into place. It was next necessary to "regulate" the frames by shoring and dubbing until they presented a fair framework for the planking, after which they were carefully shored up. The heavy keelson, which consisted of two or three great timbers placed on top of each other over the floors and fastened to the keel by great bolts, and on which much of the longitudinal strength of the ship depended, was then hauled into the vessel by oxen and tackle and put in position, and beside it went the smaller sister keelsons. Finally, the structure was completed by the fitting of the sheer strake, clamps, knees, and beams. It will be observed that the most arduous operations could be accomplished, if necessary, by a mere handful of men.

The final operations consisted of the planking, caulking, and smoothing. Planking work began at the keel and progressed upward at a rate of from two to five strakes per day in most cases. The tasks of lining the position of each plank on the frame and of tapering it toward the ends to make the planking flow evenly along the hull from the bow, where the area to be covered was small, around the bilge, where it was large, to the stern, where it was again small, likewise required skill. The planks were heated in a steam box and then carried by gangs out onto stagings and forced into position by means of screws, wedges, and bolts. The borers then bored augur holes through both planking and frames into which the fasteners inserted long locust treenails whose ends were split, wedged, and driven home with mauls. An inner skin, known as the ceiling, was often fitted in the same manner. In the caulking operations one man went ahead wedging open the V-shaped groove, which the carpenters had carefully cut the plank edges to produce, while another came along behind forcing strands

of oakum into the seam with a caulking iron and mallet. When the seam closed, and the wood swelled after launching, a water-tight seal was created which would last for years. On deck, however, the seams were filled with pitch. The final major operation consisted of the outside joiner work or planing of the hull to make it smooth, which usually required from one to five men.

Unlike modern shipbuilding, wooden construction was essentially a craft operation in which skill in the handling of simple tools was important. The primary tools used in the hewing of frames were the broad axe and the adz, the latter being a sharper tool which was used with great precision by skilled shipwrights. The sawing of planking and frames was done by means of huge two-man saws which were operated in saw pits. In many yards this task was performed in this arduous manner throughout the entire period of wooden ships, but some of the leading establishments obtained sawmills suitable for this work. The remaining work, such as the boring, fastening, and hammering was also mainly manual.

American wooden sailing ships were usually launched practically complete except for masts, spars, and outfit, although occasionally a vessel went down the ways ready for sea. Launching was normally preceded by the testing of the hull for leaks by the filling of the spaces between the inner and outer skins with water by means of a pump, which frequently was the local fire engine.[45] Second-rate builders, because of fear of ridicule or lack of facilities, sometimes neglected this operation, preferring to allow the natural swelling of the planking to check seepage. Following the test, large quantities of West Indian rock salt were poured into the frame structure, particularly between the light water line and the deck, in order to increase the resistance of the wood to decay.[46] The actual launching was a comparatively simple although festive operation. Smooth pine timbers were laid on the bed logs and covered with beef tallow, and on these slid the cradles, which supported the hull foreward and aft. On removing the shores and cutting away some of the keel blocks, the vessel would normally start on her way with a crash as the remaining keel blocks splintered, the christening being performed

[45] "The Tama-Houre-Laune," *Medford Historical Register*, Medford, Mass., XXIV (1921), 35–36; Plummer, p. 181.

[46] Griffiths, p. 306; Hall Report, p. 102; Bates, "Ship Timber," pp. 496–497.

by a young lady or, more usually, by a hardy mechanic sitting astride the bowsprit.[47] The checking of the ship was, however, a problem at those yards located on narrow waterways. Sometimes vessels were allowed to slide bow first into the opposite mud bank, from which they were extricated by the tide and tackles;[48] at other times huge raft-like devices were fastened across the stern, and large hawsers, which were held in bights by small lines designed to break in turn, were used to check the vessel's headway.[49]

The vessel was then ready to be rigged and outfitted, which work might be done by either the builder, owner, or master. Many owners, especially during the early part of the century, were very particular in this respect, and preferred to buy a bare hull and outfit it themselves. Sails, rigging, blocks, chain, anchors, and other parts were normally secured from independent contractors. Many ships, however, were finished by their builders; then they were held at the yard to be sold, or else were provided with a single or double outfit of sails and gear, and sent to sea to be delivered to the owners or sold in a maritime center. Shipbuilders sometimes operated vessels in both foreign and domestic trades for some time, pending a satisfactory sale. At some places, such as Kennebunk or Hanover, which were not seaports, much difficulty was often experienced in getting new ships downstream, it being sometimes necessary to heave them along by means of lines attached to ringbolts along the shore, or to kedge them over bars, sometimes with the aid of floats, which were called camels.[50]

5

Much depended, therefore, on the ability of the master carpenter, and hence some form of training was essential. This was normally provided by means of apprenticeships, which might be formal or informal. In an age when shipwreck and disaster were common and competition was keen, both owners and shipbuilders placed great importance on sound design and workmanship, and these depended almost entirely on the professional ability and good faith of the master builder.[51] Apprenticeship had long been the method of handing down knowledge of the shipbuilding arts and crafts, both in England and the colonies, a seven-year ap-

[47] P. McC. Reed, p. 146.
[48] Briggs, pp. 74–75.
[49] Plummer, pp. 114–115.
[50] Briggs, p. 54.
[51] L. McKay, p. 47.

prenticeship being required as late as 1815 of all shipwrights serving in the large London shipyards and Royal dockyards.[52] In the United States, however, the shortage of skilled labor made it difficult to apply the rule rigidly to all workmen, and hence apprenticeship was mainly a device for training master builders. Many of the larger yards appear to have had under indenture at one time from two to twelve boys, who were expected to study assiduously, work hard, and behave properly. In turn, these boys were often taught the "mystery" of shipbuilding with great thoroughness.[53] In many smaller establishments one or two apprentices were taken, and these were frequently sons or relatives of the builder. In this way family participation in the shipbuilding industry was sometimes perpetuated for several generations. Sons often succeeded fathers in American yards during this period. The carpenters' certificates contain names of many Badgers, Remicks, Raynes, Bournes, Wheelwrights, Thompsons, and Sewalls, among others. The period of the indentures varied from place to place and time to time, being four and a half years when Donald McKay studied under Isaac Webb at New York in the 'twenties,[54] but only three years at Boston in the 'fifties.[55] After completing an apprenticeship many young men made a practice of touring the shipyards to get experience. This system proved to be effective in providing technical leadership and in dispersing knowledge of methods of design and construction, but was hardly a substitute for a higher education in the principles of design and construction, with which few American builders were acquainted.

The entire shipbuilding operation was not a lengthy one, judged by modern standards. Once the timber was on hand, hulls could be completed in from six to fourteen weeks, depending on the size of the ship and the number of men employed. The cutting of timber locally, and the task of rigging and outfitting each required from two to four weeks. Thus both builders and owners could adapt the supply of new ships to the demand for tonnage

[52] Statement of John Hillman, Surveyor of Br. E. I. Co. ships, *Report of the* [British] *Committee on East India-Built Shipping* (1814), Parliamentary Papers, 1813–1814, VIII, 3–6.

[53] Wild, pp. 77–78.

[54] R. C. McKay, p. 6.

[55] "Report on Difference of Expense of Repairing Vessels at Boston and New York," *Annual Report of the Boston Board of Trade, 1856*, p. 7. (This publication is hereafter cited as *R.B.B.T.*)

with considerable promptness. Warships and vessels requiring special timber such as live oak required a longer period, however, sometimes running to two or three years. Many builders appear to have secured contracts or made plans for construction on their own account in the fall, cut their timber in the winter when it could be hauled easily and the sap was out of the wood, and completed their vessels in the late spring and summer, judging from the dates of documentation of new vessels at Boston and elsewhere. In eastern ports, where much timber was secured locally, this seasonal routine was particularly pronounced.[56] In general, in the case of white oak ships, the entire process from tree cutting to commissioning took but from four to seven months, and even this time could be greatly reduced on occasion.

6

Although the primary material in wooden ship construction was timber, ther were a number of other items — namely, iron fastenings, chain, and anchors, copper fastenings and sheathing, canvas and sails, and hemp and wire rigging — which collectively comprised from 15 to 40 per cent of the cost of a sailing ship, depending on the type of construction, extent of the outfit, and price. It is important to note that to a certain degree foreign builders had advantages in securing supplies of such articles, and that these advantages tended to neutralize, in part, the advantage in timber prices possessed by American builders.

Iron, which was used in countless places in the fastening of the frames and rigging, was required in increasing amounts during the nineteenth century, until by 1850 some forty pounds were required for every displacement ton of shipping.[57] In addition, each vessel required three or more anchors, each of which might weigh as much as five tons in the case of a frigate or clipper, together with several hundred fathoms of chain cable, which by 1815 was rapidly superseding the bulky, awkward, and destructible hempen cables formerly used. Chain is said to have been first introduced for this purpose in England in 1811.[58] By 1850 chain

[56] D. Q. Cushman, *History of Ancient Sheepscot and Newcastle* (1882), p. 327; Hall Report, pp. 100–101.

[57] Griffiths, p. 316.

[58] William Coffin, iron merchant, "Report on Chain Cables," *R.B.B.T.*, *1857*, p. 59.

was also being used in the more important parts of the running rigging, such as the topsail halyards and sheets, where the strain was severe. The builders of wooden ships, therefore, required a good supply of iron.

During the early colonial period the American settlements had possessed some advantage in the production of pig and bar iron, for charcoal-burning furnaces were then in use and the high degree of exhaustion of the European forests made it advantageous to smelt in the new-world forests. Consequently numerous iron works employing bog ore developed along the coast in the seventeenth and eighteenth centuries.[59] Some of these works were able to make the ironware needed in ship construction, but frequently builders found it necessary to secure part or all of their supplies of iron or ironware, as well as those of sails, cordage, and blocks, from England.[60] After 1750 the cost of producing iron declined considerably in England, because coke came to be used in the blast furnaces as a result of the pioneering of Abraham Darby and the subsequent inventions of Henry Cort for puddling and rolling iron.[61] Consequently, during the nineteenth century, the prices of British iron and iron products fell below those prevailing in the United States, and American shipbuilders became highly dependent on imports. For this reason, during the Revolution the interruption of trade had seriously hampered shipbuilding operations.[62] More serious, however, was the rise of protectionism, which, beginning in 1816, taxed domestic consumers in the form of higher prices. Indeed, price levels were from 40 to 100 per cent in excess of those prevailing abroad from that date until about 1840.[63] The shipbuilders of Philadelphia estimated in 1830 that the duties on the thirty-seven tons of iron required for the anchors, chains, fastenings, and fittings of a 500-gross-ton ship amounted to $1295, or 19 per cent of the estimated price of $25,000.[64] Since

[59] A. C. Bining, *The Pennsylvania Iron Manufacture in the Eighteenth Century* (1938), pp. 16–26.

[60] H. E. Gillingham, "Some Colonial Ships Built in Philadelphia," *Pennsylvania Magazine of History and Biography*, LVI (1932), 174–179; Adams, p. 258.

[61] For an account see T. S. Ashton, *Iron and Steel in the Industrial Revolution* (1924).

[62] L. F. Middlebrook, *History of Maritime Connecticut During the American Revolution, 1775–1783*, 2 vols. (1925), I, 219–220.

[63] F. W. Taussig, *Tariff History of the United States*, 8th ed. (1931), p. 55.

[64] *Memorial of the Shipbuilders of Philadelphia* (1830), House Rep. no. 369, 21 Cong., 1 Sess., pp. 2–3.

the bulk of the supplies of iron, anchors, and chain came from overseas, there being but a few domestic producers,[65] it is evident that the shipbuilders were fully justified in protesting against the duties. As the importance of iron in construction increased, the relatively high cost of iron became a matter of major consequence.

Another costly material was copper, which was used in the fastenings of high-class ships and as a sheathing to protect the underbody against worms and fouling. Sheathing was particularly important for vessels passing through the tropics on long voyages. It was probably first employed on His Majesty's Ships *Alarm*, *Aurora*, and *Stag*, in 1761, 1765, and 1770, respectively, and it became common in the British Navy after 1776.[66] After 1800 the more important American merchantmen were generally sheathed, but the rise of the American copper industry awaited the development of the western mines, which was not to occur until after the Civil War. Consequently, until then American ships sailing for Europe were coppered there, but those bound for California, China, or India were sheathed at home.[67] American owners and builders thus often had trouble in securing copper on as favorable terms as those abroad.

In contrast, American sailing ships during much of the nineteenth century were supplied with domestic cotton canvas. During the eighteenth century and the early part of the nineteenth century, sails were made of flax, part of which was obtained in the colonies. Although several canvas mills were in operation in or close to the American seaports at the end of the eighteenth century,[68] a considerable amount of this demand was satisfied by imports from England. During the second quarter of the nineteenth century, however, cotton duck supplanted flax. "Cotton sails hold more wind, are much more pliable, and easily handled," reported Captain Wilkinson of the U.S.S. *Adams*, on which cotton

[65] Taussig, *Tariff History*, p. 55; Coffin states that there was but one manufacturer of ship chain in the United States between 1820 and 1850, namely the firm of Cotton & Hill of Boston. Imports of anchors and chain totaled 461 tons and 7925 tons, respectively, in 1856, a good shipbuilding year. See *R.B.B.T.*, *1857*, pp. 59–62.

[66] W. J. Hay, "Developments in Copper Sheathing in the British Navy," *Trans. I.N.A.*, IV (1863), 80–81.

[67] Statement of Paul Curtis, Medford shipbuilder, Lynch Report, p. 94.

[68] V. S. Clark, *History of Manufactures in the United States*, 3 vols. (1916–1929), I, 530.

topsails were bent in 1826.[69] The manufacture of cotton goods in the United States was greatly stimulated by the interruptions of trade between 1808 and 1815,[70] and numerous mills were established, including several for the manufacture of cotton duck, the first being a small plant established by Seth Bemis at Watertown, Massachusetts, in 1809.[71] This firm, which originally employed but six weavers, sold cotton canvas as far south as Baltimore during the War of 1812, and was equipped with a power loom in 1816. The manufacture of sail cloth rapidly increased after the war, plants being established in Paterson in 1822, Baltimore, and elsewhere. Later, as American shipping expanded, this business increased. A large mill exclusively for the manufacture of canvas was constructed at Lowell in 1840. At the peak of the sailing-ship boom, in 1856, the industry was producing some 13,000,000 yards annually, of which about 5,000,000 yards came from New England.[72] Although protected by substantial duties after 1816, the price of canvas fell, owing to decreasing costs of cotton, economies of large-scale production, and improvements in technique. No. 1 weight sold at 65 cents per yard in 1809, at 41 cents in 1826, and at 35 cents in 1831. By 1826, cotton was cheaper than flax canvas, which was then priced at 48 cents for the same weight.[73] The cotton manufacture in general was by then firmly established, and the tariff probably was ineffective.[74] American ships thereafter used cotton sails almost exclusively, although flax was still employed extensively on foreign vessels.

Each ship was provided with one or more suits of sails, which were generally made up in one or more of the numerous craft shops, called sail lofts, which were to be found in every seaport and shipbuilding center. Few sail lofts were directly attached to shipyards. The work, which required considerable skill, consisted of the fitting together of strips of cloth, the fastening of

[69] *Report on Experiments to Test the Comparative Fitness of Cotton and Hemp for Sails and Cordage in the Navy* (1829), House Doc., 20 Cong., 2 Sess.; reprinted in A.S.P., N.A., vol. III, no. 383, p. 301; *Report on the Substitution of Cotton for Hemp and Flax for the Canvas of the Navy* (1835), House Rep., 23 Cong., 2 Sess.; reprinted in A.S.P., N.A., vol. IV, no. 582, p. 719.

[70] Taussig, *Tariff History*, pp. 27–29.

[71] "Report on Cotton Sail Duck," *R.B.B.T.*, *1857*, pp. 65–66.

[72] "Report on Cotton Sail Duck," *R.B.B.T.*, *1857*, pp. 65–68.

[73] *Report on the Substitution of Cotton for Hemp and Flax for the Canvas of the Navy* (1835), p. 719.

[74] Taussig, *Tariff History*, p. 35.

the boltrope around the outside edge, and the attaching of reef-points and cringles. This was done almost exclusively by hand with palm and needle.

During the sailing-ship age, cordage, which was used both for the standing rigging supporting the masts and spars and for the running rigging, was of primary importance, particularly before the introduction of steel wire about 1870. This was made of hemp in numerous long buildings known as ropewalks which were to be found in almost every seaport.[75] The chief problem centered around the use of foreign, chiefly Baltic, hemp, which was preferred for ship use because of its strength and durability. The growing of hemp required a considerable amount of labor, and hence was a relatively costly industry in America. In addition, the domestic product was believed to be inferior for maritime use because of dew rot, to which it was liable.[76] Accordingly, a struggle arose over the issue of protection, which was won by the hemp growers of Pennsylvania, Kentucky, and the other states of the middle group, and resulted in the establishment of a duty of $20 per ton in 1792. This was later increased in steps to a pre-Civil War peak of $60 per ton in the Act of 1828, and was then lowered somewhat, being 30 per cent ad valorem in the Walker Act of 1846. Imports continued on a substantial scale, however, rising slowly from about 3400 tons per year before 1800 to about 5000 tons per year between 1820 and 1840,[77] thus indicating that all or nearly all of the tax was added to the price. Under the Act of 1830 the duties on the twelve tons of hemp required for the rigging of a 500-ton ship amounted to $720.[78] This rigging had to be renewed about every three years. The hemp duties were, therefore, a substantial burden on the shipbuilding industry.[79] Ships were consequently supplied with cordage whenever possible in foreign ports.

It thus appears that the advantages of the American shipyards

[75] For example the rope-walk of Jeremiah Johnson at Portsmouth, N. H., a large establishment, consisted in the 'fifties of an 800-foot shed, two-storied for 400 feet, which employed from thirty to forty men and was operated by steam power. See C. W. Brewster, *Rambles about Portsmouth*, 2 vols. (1859), I, 170–171.

[76] *Report on the Use of American Cables, Canvas, and Cordage in the Navy* (1825), Senate Doc., 18 Cong., 2 Sess.; reprinted in A.S.P., N.A., vol. II, no. 265, pp. 27–28.

[77] V. S. Clark, I, 326.

[78] *Memorial of the Shipbuilders of Philadelphia* (1830), pp. 2–3.

[79] Taussig, *Tariff History*, p. 91.

in respect to the timber supply were somewhat modified by the necessity of paying, throughout the sailing ship period, prices considerably above the world-level for such items as iron and cordage. Thus at an early date protectionism became somewhat of a burden. Indeed as the importance of iron and other protected articles in shipbuilding increased, and the advantage in timber prices diminished, the burden increased until it became a major restrictive force.

7

The final stage in the shipbuilding process was the sale of vessels. In this the master carpenter had an opportunity to display his commercial abilities. In general, during the sailing-ship period an active market for vessels prevailed, and builders experienced little difficulty in disposing of their tonnage. In contrast, by the beginning of the twentieth century there was no active market for new ships, for nearly all vessels were then built on contract and to special designs. This practice was not so common, however, in the sailing-ship era. The principal types of vessels — the full-bodied freighters, the sharp-built craft, fishermen, and coasters — were more or less standardized, and builders could normally expect, therefore, to dispose of their craft in the ship markets without much difficulty. Hence new ships were continually being offered for sale, and owners and captains were continually on the lookout for them. In this way many ships passed into the hands of their owners.

There was a very considerable variety in the relationships between builders and owners. Many owners preferred to patronize particular builders, with whom they had become acquainted and on whom they relied to build the type of ship desired. Some desired to watch carefully the process of construction and to discuss details with the builders, and hence ordinarily preferred local firms if other things were equal. Others, however, among whom was Salem's great magnate, William Gray, bought new vessels from a wide range of yards. Owners also frequently preferred to buy bare hulls only, and to provide the copper sheathing, masts, spars, sails, rigging, and equipment themselves. Hence prices were generally quoted both on bare hulls and on vessels completed and ready for sea, and equipped with either single or double outfits. Usually the bare hull was quoted at from 50 to 70 per cent of the price of the completed vessel.

The established shipyards built at a relatively steady pace, which was altered only in accordance with general conditions in the shipping industry. In normal times, typical moderate-sized yards built from one to three ships or brigs each year, while in boom times this figure might be as much as doubled, and in slack times it might be reduced. Builders were not deterred, however, by a failure to secure a contract. If a master carpenter was fortunate, during the late summer or fall, he might secure contracts for one or two vessels, but if not, construction was begun on speculation. When the planking stage was reached such vessels were usually advertised in the commercial papers of Boston, New York, Philadelphia, and other ports, and visits from owners and captains who were touring the shipyards might be expected.[80] If the ship was not sold in this manner, it was normally sent to sea, sometimes empty, but usually laden with a cargo for a major seaport, where it was again advertised by commission agents or by the captain, and was opened for inspection. Normally the ship would be sold within a short period, but if not, instructions were usually issued to the agents or master to load a cargo for a foreign or domestic port. Sometimes a sale was not consummated until several voyages had been made. There was, therefore, a continual supply of new tonnage appearing on the market, the period of greatest activity being between the first of May and the last of August.

The ship markets of the principal American seaports appear to have been very active during the first half of the nineteenth century, although only fragmentary records are available. At Boston, for instance, several transfers of shares of new or old vessels occurred daily, as is shown by the records of registers and enrollments. At this time the ownership of vessels was usually divided into halves, thirds, fourths, fifths, sixths, or eighths.[81] Full-rigged ships were usually owned by from one to four men, of whom one was usually the master and one might be the master carpenter, although on several occasions as many as forty names appeared on the registers. Small fishing and coasting vessels were sometimes owned by so many as to suggest that the crews or their families were the owners. In some cases, the same group of names appeared on many registers, with the possible exception of that of the captain, thus indicating unified control. In general, how-

[80] See for instance Wright, p. 77.
[81] Boston Registers and Enrollments, 1815–1824.

ever, the composition of the ownership interests was varied, there being a few important names, usually those of the managing owners, and others, some of which might appear but once or twice. It was to such partnerships that the shipbuilders sold. Normally much trading of ship shares occurred. This business was arranged and conducted by ship brokers and shipping firms, some of which acted as consignees of new ships. Thus a fairly continuous and active market was secured in the important centers, and some uniformity of prices was achieved, although instances appear in the sales books of transactions occurring on the same day at widely differing prices. Judging by the dates of the issuance of registers and enrollments at building ports, and those of the new documents at the ports of sale, new vessels were usually sold within four months of completion, and sometimes this occurred within a few days of the offering.

Shipbuilders frequently became involved in shipowning and navigation in the course of their operations. The small builders frequently found it necessary to sail their ships to the nearest market, and personally to conduct the selling operations; and, if no purchaser was found, to navigate the ship in the foreign or coastwise carrying trades until a sale was possible. Others found it desirable to take a share in the vessels when sold, usually a quarter or an eighth, in order to secure further orders, repair work, or an opportunity for investment. In some cases, owners expected the builders to take a share as a guarantee of sound workmanship. In other cases, the builder financed the owners by taking as much as three fourths of a vessel under an agreement specifying time payments. This arrangement was particularly common in the case of the cod-fishing schooners built at Hanover, Scituate, Boston, Ipswich, and Newburyport. In such cases the builder became a promoter. The extent to which this could be done was limited, however, because most builders possessed only a moderate amount of capital, and were frequently forced to borrow from banks or merchants.

Some builders were even able to make the transition from shipbuilding to shipowning. Among the most notable of these was Thatcher Magoun of Medford, a noted builder who eventually became an important Boston owner of clipper ships, establishing in 1833 the firm of T. Magoun & Sons.[82] For his own firm he

[82] French, pp. 1–13.

built the ships *Timoleon*, 445 tons, *Archimedes*, 452 tons, *Malo*, 492 tons, and *Deucalion*, 509 tons, but beginning in 1836 he leased his yard, first to Waterman & Ewell, and then to Hayden & Cudworth, who built the remainder of his fleet of eleven ships. Judging from the register books, other shipbuilding firms also eventually found that their shipping interests overbalanced those in shipbuilding, and abandoned the latter. On the whole, however, this was a rare development. Although to the eastward in Bath and other ports important integrated firms were beginning to rise, the shipping and shipbuilding enterprises were for the most part sharply distinguishable in American economic life prior to the Civil War.

CHAPTER V

THE BACKGROUND: THE SHIPBUILDING AND SHIPPING INDUSTRIES IN THE COLONIAL PERIOD

I

THE ECONOMIC DEVELOPMENT of the world's shipping industry during the three centuries preceding American independence was fundamentally influenced by two important changes; namely, the growth of the shipbuilding industry in North America and the establishment of the highly protective British navigation system. These two forces greatly contributed to the rapid rise of the shipping industry of the British Empire. They necessarily also greatly influenced the development of the American maritime industries after the Revolution and are, therefore, essential elements of the American background. We shall first turn our attention to the growth of the shipbuilding industry in North America.

During the entire period from the settlement of the English colonies in the seventeenth century to the rise of the construction of iron ships in the mid-nineteenth century the tremendous attractive force of the new regions possessing superior resources of ship timber produced a movement of the shipbuilding industry away from the maritime centers of Northwest Europe to these areas. Among these areas none was more favorable than the seaboard of the English colonies from Maine to Virginia. In these colonies, where shipbuilders could secure magnificent virgin timber from forests so extensive as to be a nuisance, the costs of shipbuilding were extremely low. Many builders, indeed, needed to expend but a small sum or a small amount of their own labor to cut and haul the timber. In contrast, the less well-situated shipbuilders of Europe were forced to secure their supplies from great distances at large expense, or to pay high stumpage prices for scarce local timber supplies. Furthermore, the middlemen who conducted the timber trade were sometimes able to secure monopoly profits. Moreover, the timber might not be of the de-

sired shapes, or might be decayed on arrival. Finally, import duties and war losses frequently increased the cost of securing a supply. Hence, the rising shipbuilding industry of North America possessed a tremendous advantage.

The economic development of the new overseas regions greatly disturbed the formerly rather stable equilibrium of Europe in shipbuilding as in other industries. The fact that a basic change was to take place was clearly visible by the time of the Dutch Wars; it was foreseen by the able economist Sir Josiah Child, who wrote: "Of all the American plantations, His Majesty has none so apt for the building of shipping as New England."[1] Since the American timber resources were not concealed, and the best of ship timber was available everywhere along the American coast, it was obvious to shipbuilders and owners that there were great natural advantages to be obtained by construction overseas. During the colonial period, therefore, great interest centers on the attitude of the governments and shipbuilders in the older areas toward the migration of the industry, on the division of the new timber resources among the rival mercantilist nations, on the trade in ship timber, and on the effects of the rise of the shipbuilding in colonial regions on ship prices, costs of navigation, and the competitive positions of the rival national merchant fleets. After the American Revolution, however, interest centers on the effects of the great advantages which the American shipbuilders and owners and the American Navy were able to secure by virtue of their almost exclusive command of this resource, and on the resulting competition and struggles for maritime supremacy. The economic influence of the American forests and shipyards was felt in Europe with increasing strength from very early in the seventeenth century until late in the nineteenth century.

Until the time of the Discoveries it is unlikely that the rapid rate of depletion of the local timber supplies caused serious disturbances in the maritime centers of Europe. Although some such centers, notably Venice, northern Spain, and Holland, could obtain supplies only with difficulty and from a distance, nevertheless the timber required for the relatively small merchant ships of the period prior to the sixteenth century was still readily available from the Baltic to the Mediterranean, and consequently ship construction could be economically undertaken along much of the

[1] Sir Josiah Child, *A New Discourse of Trade* (1668), 5th ed., 1751, p. 162.

European seaboard. It may be concluded, therefore, that although the extent of the forests about 1500 was less than it had been in mediaeval times, nevertheless the supply was still relatively ample. The resource was not being maintained, however, and hence difficulties were certain to appear.

The supply of good ship timber was depleted at an increasing rate during the sixteenth, seventeenth, and eighteenth centuries for several reasons. The volume of seaborne trade increased with great rapidity because of the Discoveries, the establishment of overseas colonies, the growth of industrial production, and the improvements in ship design. There were substantial increases in population, and in the volume of manufactured goods and agricultural products carried by sea. The coastwise trades of Europe expanded, especially those from the western ports to the Baltic and Mediterranean. The carriage of British coal coastwise and overseas, perhaps the first of the great raw-commodity trades, rose from an insignificant business in the mid-sixteenth century to one employing about 1600 vessels at the end of the seventeenth century.[2] The chief imperialistic nations — England, Spain, Holland, France, and Portugal — also required a large amount of additional tonnage, much of it of large size, for the new American, West Indian, and East Indian trades. The Spanish plate fleets alone usually numbered from thirty to ninety vessels at the close of the sixteenth century.[3] The rival East India companies — British, French, and Dutch — became important purchasers of large heavily armed ships during the sixteenth, seventeenth, and eighteenth centuries in order to carry their cargoes and to supply the rival military and naval establishments. Trading operations with North America also required numerous small freighters. To a large extent the rise of these new overseas carrying trades meant a net addition to the tonnage requirements of the western world, although a certain amount of Levantine navigation was probably displaced. At the same time the use of wood for building construction and ironmaking expanded, and forest land was being converted into arable and pasture land. As a consequence a serious disequilibrium between the rates of growth and cutting of timber appeared in many places.

[2] J. U. Nef, *The Rise of the British Coal Industry*, 2 vols. (1932), I, 172.
[3] C. H. Haring, *Trade and Navigation Between Spain and the Indies in the Time of Hapsburgs* (1918), pp. 211–212.

The tonnage of the merchant fleets of Europe consequently expanded with considerable rapidity, especially in the thickly populated countries of the West where, because of monopolies and the quantity of labor and capital available, the chief impetus was felt. It is not necessary here to enter into a discussion of the quantitative aspects of this expansion, for the primary fact is that by 1800 the timber supplies were seriously depleted in the western countries, with the result that conditions of sharply increasing supply price then prevailed. The expansion of the shipbuilding industry was particularly notable in the Netherlands in the seventeenth century, owing to the excellence of Dutch designs, the economies achieved through large-scale shipbuilding, the skilled labor supply available, and the low interest rates prevailing.[4] To support this activity the Dutch were forced to tap distant timber resources on the upper Rhine and along the Baltic coast. British shipping and shipbuilding also grew rapidly, starting in the reign of Henry VII, because of the growth of production and trade.[5] A five-fold increase in the number of vessels of 100 tons and up documented is indicated between 1560 and 1629.[6] A rapid and steady rise in tonnage, except for brief periods of recession, has also been shown to have occurred during the long period from the Restoration to the World War.[7] In Spain and France there was much activity in shipbuilding, although the rate of expansion was somewhat less than in England. Spanish shipping probably ranked second to the Dutch near the close of the sixteenth century.[8] Thus it is evident that the rising volume of merchant ship construction in these nations made increasingly large demands on the forests.

The depletion of the forests was also accelerated by the notable increase in warship construction which resulted from the rise of rival national states. In the era of high mercantilism resources, markets, and trades were monopolized wherever possible

[4] Violet Barbour, "Dutch and English Merchant Shipping in the Seventeenth Century," *Economic History Review*, II (1929–30), 272–282.

[5] C. E. Fayle, *A Short History of the World's Shipping Industry* (1933), p. 138.

[6] Nef, "A Comparison of Industrial Growth in France and England from 1540 to 1640," pt. I, *Journal of Political Economy*, XLIV (1936), 308.

[7] A. P. Usher, "The Growth of English Shipping, 1572–1920," *Quarterly Journal of Economics*, XLII (1928), 466–474.

[8] Usher, "Spanish Ships and Shipping in the Sixteenth and Seventeenth Centuries," *Facts and Factors in Economic History* (1932), p. 212.

for the benefit of national entrepreneurs or the government, and wars constantly arose. Hence navies played a more important role than formerly, both in the protection of overseas shipping and in the defense of the state. The massive ship-of-the-line, a veritable monument to destroyed forests, became a common sight in all of the shipyards of Europe. The demand generated by the rival naval construction programs soon depleted the forests of the largest and best oaks and other trees. Naval construction often caused, indeed, a more serious drain than merchant-ship construction, especially in France and England.

This expansion in the building of both naval and commercial vessels was based on the utilization of timber resources which, for economic reasons, were to be practically irreplaceable. Serious local distress became clearly apparent as early as the sixteenth century, and by the opening of the nineteenth century shortages had become so widespread as to be for practical purposes general in the ports of the great western nations. The lack of good transportation facilities for heavy materials contributed to limit the size of the supply which was economically available. Overland hauls were restricted to about twenty-five miles because of the cost. The supplies located in the interior were reached principally by means of waterways. The great river systems of Europe, such as the Rhine, Rhône, Loire, Elbe, and Weser, the many smaller rivers, and the new canal systems of France, Germany, and England, were the primary arteries. The interior supplies, however, were also being rapidly depleted. Thus both the coastal and interior stands of ship timber which were readily accessible by the means then in use were being rapidly destroyed to meet the demands of the shipbuilders. Despite the attempts which were made to conserve the forests, this depletion continued unchecked.

The timber problem had indeed reached the crisis stage by the end of the eighteenth century. In Great Britain, where extensive virgin forests had existed in the reign of Henry VIII, the wooded area amounted to but one eighth of the total at the end of the seventeenth century [9] and had nearly disappeared by 1800.[10] Wheat growing, which yielded a quick cash crop, was found to be a more profitable way in which to use good land. The Royal

[9] Albion, *Forests and Sea Power*, p. 97.

[10] J. H. Clapham, *An Economic History of Modern Britain*, I (1930), 9.

Forests, private parks, and estate hedgerows had, through mismanagement, alienation, and depletion, lost most of their stocks of serviceable ship timber. Surveys made in 1783 showed but 50,000 loads of oak of large size in the six chief Royal Forests, compared with 234,000 loads in 1608;[11] and a further survey made in 1792, which included the private estates, showed that only a limited amount of oak, much of it of small size, was available.[12] Hence, during the nineteenth century, until the substitution of iron for oak, it was impossible to secure in Great Britain more than a small proportion of the ship timber required for the nation's shipyards. Shipbuilders complained in the 'fifties that the Navy had secured "every load of timber which any amount of money could have gotten." [13] Large oak pieces for keels, stems, and sternposts were then practically unobtainable,[14] and builders were forced to import them, or to employ undersized oak or inferior woods, such as fir. Even small masts were unobtainable. Fortunate, indeed, was Britain that Watt, Boulton, Fairbairn, Brunel, and countless others provided the leadership necessary to convert the country into a center for the construction of iron ships, for by 1886, despite the scattered trees which adorned the countryside, scarcely 5 per cent of the area of England and 4 per cent of that of Scotland was wooded, and these forests were not of a type readily sacrificed.[15] This growing timber shortage, which hampered ship construction more or less continuously after the Dutch Wars, was of one of the primary factors influencing maritime history.

A similar crisis developed on the Continent. Venetian shipbuilding appears to have been seriously checked by timber difficulties in the sixteenth century.[16] A shortage also affected Spanish shipbuilding, particularly along the Biscayan coast, early in the

[11] Albion, *Forests and Sea Power*, p. 136; *Eleventh Report of the* [British] *Commissioners Appointed to Inquire into the State of the Woods, Forest, and Land Revenues of the Crown* (1792), Journal of the House of Commons, 1792, p. 271.

[12] *Eleventh Report on Woods, Forests, and Land Revenues*, pp. 264–374.

[13] R. Dundas, Storekeeper-General of the British Navy, quoted by Albion, *Forests and Sea Power*, p. 405.

[14] Statement of Clifford Wigram of Money, Wigram & Sons, important London shipowners, *Report of the* [British] *Select Committee on Merchant Shipping* (1860), Parliamentary Papers, 1860, XIII, 18; T. J. Ditchburn, in discussion, *Trans. I.N.A.*, IV (1863), 148.

[15] Clapham, *An Economic History of Modern Britain*, II (1932), 500–501.

[16] Lane, chap. xii.

seventeenth century,[17] and the industry there subsequently declined. Evidences of pressure there are the construction of numerous ships for the American fleets in the colonies and the purchase of foreign-built vessels and foreign timber. Holland had almost no timber of the requisite size.[18] In France, difficulty in securing ship timber also developed. An acute shortage appears to have arisen in the latter seventeenth century, despite the efforts of Colbert and other ministers to conserve the forests; and resort, therefore, was had to Baltic supplies.[19] Domestic timbers were then secured primarily in the inland provinces, especially Béarn, Provence, and the Vosges.[20] France, like Holland, England, and Spain, soon was forced to rely extensively on imports. Only in Germany, Poland, Russia, and Scandinavia were timber resources ample, but the mercantilistic policies pursued by the leading western powers seriously limited the market for shipbuilders located in these latter regions. By the nineteenth century, the Baltic seaboard was the only region in Europe where wooden ships could be economically built in large numbers.

Conservation and reforestation measures, although sporadically undertaken, proved to be an inadequate defense against such depletion. The long period of growth required for ship timber, the risk of loss by fire or decay, and the probability that the returns would be reaped by successors, together with the profitability of grain growing on the same land, militated against the planting of oak. At no time does the price of oak appear to have been sufficient to induce a rate of planting equal to that of depletion. Forest land was often plowed up or converted into pasture after cutting. The English wheat duties accelerated this development considerably, especially in the nineteenth century. As always, the largest trees were cut first, and their replacement became particularly difficult to secure. The shortage, therefore, first hampered the builders of large vessels. The shipbuilding industry in Europe thus was based on the unstable foundation of a diminish-

[17] Usher, "Spanish Ships and Shipping," pp. 202–204.

[18] Barbour, p. 272. There was however a considerable supply in Western Germany obtainable by means of the Rhine River. See Franz Heske, *German Forestry* (1938), pp. 23–25, 47–50.

[19] P. Boissonade, *Colbert, le triomphe de l'étatisme, la fondation de la suprématie industrielle de la France, et la dictature du travail* (1932), p. 111.

[20] G. Renard and G. Weulersse, *Life and Work in Modern Europe* (1926), pp. 230–231; Boissonade, p. 112.

ing timber supply, and the governments of the western powers were unable to take adequate measures to check the decline in the economic position.

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Hence the shipbuilding industry of western Europe was soon forced to secure supplies overseas in areas possessing abundant forests. A rapid movement of the industry toward these regions should have been the normal result. This movement was substantially checked, however, by the industrial backwardness of the colonies, the obstacles to the migration of capital and labor, and the laws governing the registry of vessels. Hence the movement developed slowly and the migration never was fully completed. Meanwhile it was necessary to import timber supplies into western Europe on a large scale.

The primary sources of timber imports were the Baltic ports from Stettin to St. Petersburg, which were centers for a large trade in oak, pine, fir, and other timbers. Much of this stock originated inland on the feudal estates bordering the great rivers of this area. The Vistula, with Danzig as its port, brought down to the sea the timber of Poland, and drew stock from places as far distant as Galicia.[21] The interior of Germany was tapped by the Oder, which entered the sea at Stettin. Riga received supplies by the Düna from Volhynia and the Ukraine. Masts and spars were secured in these ports, and also in Scandinavia. These supplies were regularly cut on the great feudal estates which sprawled across the land, and were sold to the numerous timber merchants located in the ports, many of whom were English, Dutch, or French, who, in turn, shipped the timber in large lumber droghers by way of the Danish Sound to western ports. This trade was of vital importance to the maritime development of Holland, England, France, and Spain. It is evident that this area was the cheapest source of supply for British builders as early as 1686, for even then five loads of Baltic plank were used for each one of English origin.[22] The British government, therefore, was greatly concerned to keep the Baltic open, even going so far as to send fleets against Copenhagen for this purpose. The Baltic ports were the first and most natural sources of imports of ship timber.

[21] Albion, *Forests and Sea Power*, pp. 140–141.
[22] Barbour, pp. 269–270.

Another source of supply was North America, which, although considerably more distant than the Baltic, had the advantage of possessing abundant virgin timber at the water's edge. Probably no other region possessed such excellent stands of ship timber within easy reach during the colonial period. Although this timber was later to be the foundation of the extensive American shipbuilding industry, nearly two centuries were required to establish an industry possessing sufficient labor, capital, and technical skill vitally to influence the world supply of tonnage. Consequently, pending the relocalization of the industry, ship timber was exported in large quantities not only to England but also to other countries. Since it was the primary marketable resource available in the colonies, large amounts were cut and placed on the market in the process of clearing the land. Eastbound ships found in it a convenient bulk cargo. Large pieces, such as great pine masts and oak futtocks, were in particular demand in Europe, where trees of the largest size were becoming rare. The American forests, therefore, soon became of great importance to the European shipbuilders.

The value of the North American forest resources and their significance in the struggle for naval supremacy and trade was recognized early by European statesmen. Under conditions of free trade the new timber supplies would have been available to all of the shipbuilders of Europe, and the low-cost ships built in America would have been freely sold in the world market. The actual policy pursued by most nations, however, produced very different results. First, strong measures were taken to protect the national shipbuilding industries as far as possible in order to assure the maintenance of shipyards and of skilled workmen able to construct war fleets quickly. Second, efforts were made to develop secure sources of ship timber and to prevent these supplies from reaching rivals. Hence a complicated situation arose in which timber and new ships did not flow freely to European markets.

The exportation of North American ship timber and other forest products began as soon as settlements were made. As early as 1587, English seamen noted "the firre trees fit for masts of ships, some very tall and great." [23] In 1609, a cargo of eighty

[23] Thomas Heriot, "A Brief and True Report of the New Found Land of Virginia," *Hakluyt's Voyages* (Everyman Edition), VI, 184.

pine masts was shipped from Virginia on the ship *Starre*, and this was followed in 1634 by the first New England shipment.[24] The interruptions of the Baltic trade during the Dutch Wars particularly stimulated the exportation of North American timber to England. The first large shipment of great naval masts arrived in 1653, some of which were stepped in the ship-of-the-line *Naseby*.[25] Such vessels required masts of a diameter of thirty-six inches or more. Shipments of white pine masts from the forests extending from New Brunswick to Pennsylvania subsequently increased, and in addition oak planking and frame timber were exported in considerable volume.

The timber trade grew with the expansion of the settled area and the development of organization. The primary focus of the trade was in eastern New England, where the Merrimack, Piscataqua, Saco, Kennebec, Sheepscot, and other streams gave access to excellent timber stands. Portsmouth, at the mouth of the Piscataqua River, was during the seventeenth and eighteenth centuries the leading center of this timber and mast trade.[26] From this port the number of shiploads sent annually reached ten as early as 1671.[27] Fires and the depletion of the New Hampshire forests forced the extension of the trade during the eighteenth century eastward to Kennebunk, Saco, Falmouth,[28] Yarmouth, Freeport, Bath, and other ports as far east as Machias.[29] The operations of the cutters of ship timber were extended further eastward to New Brunswick and Quebec in the nineteenth century. The ship timber trade also arose during the eighteenth century on the Merrimack,[30] the Connecticut, which provided a natural outlet for the forests of the interior of New Hampshire and Massachusetts,[31] the Hudson, and the Delaware.[32] Not until the close of

[24] *Calendar of State Papers, Colonial Series, America and West Indies*, IX (Addenda, 1574–1674), 76. (Hereafter cited as Cal. S.P.A. & W.I.)

[25] Albion, *Forests and Sea Power*, p. 213.

[26] Cal. S.P.A. & W.I., XVIII (1700), 680; Belknap, II, 117, III, 198, 203–204, 210; Albion, *Forests and Sea Power*, p. 235.

[27] E. L. Lord, *Industrial Experiments in the British Colonies of North America* (1898), p. 4.

[28] Rowe, chap. ii; W. Willis, *History of Portland* (1865), pp. 453–454; Albion, *Forests and Sea Power*, pp. 242, 271.

[29] Albion, *Forests and Sea Power*, p. 271.

[30] J. J. Currier, *Historical Sketch of Shipbuilding on the Merrimack River* (1877), p. 24.

[31] Cal. S.P.A. & W.I., XVIII (1700), 358–359.

[32] Scharf and Westcott, III, 2336.

the colonial period, however, do European builders appear to have become aware of the advantages of the southern hard pine and live oak. Thus American supplies were used to support the poorly localized shipbuilding industry of Europe at an early date.

It is evident that the shipping industries and navies of the western European powers, especially Great Britain, which secured by far the larger part of the shipments, were considerably strengthened by the use of the colonial timber resources in North America. Control and conservation were accordingly matters of primary importance, especially from the standpoint of the leading sea power, Great Britain. Conservation policies, however, were unusually difficult to establish in the Colonies, and later in the United States, because of the apparent abundance of resources, the policy of simple private ownership of land, and the normal tendency for individuals to maximize their profits in the present. Consequently persons receiving grants or purchasing land commonly cut timber freely with little regard for the future interests of the Navy, the merchant marine, or their own heirs. The largest and most accessible trees were cut first, and were often cut up into planking at the numerous mills. Whole forests were often slashed, and the brush left on the ground caused fires which increased the rate of destruction, especially in the vicinity of Portsmouth, where in 1762 much of the available supply was destroyed.[33] So rapid was the depletion that before the end of the colonial period, in many old centers of the trade it was necessary to seek trees of the largest size some distance inland.

By the late eighteenth century there had been sufficient depletion of ship-timber trees because of local construction activity, exportation, and land-clearing to produce a supply condition of slowly rising costs. The seventeenth century had witnessed the settlement of much of the seaboard, and the eighteenth saw the extension of exploitation inland. During the latter period timber contractors operated frequently at considerable distances up the streams and inland along crude roads leading to the river banks.[34] One result of these operations was the creation of a conservation policy which, although unpopular, was consistent with the need of maintaining British naval power and shipping. As early as

[33] Albion, *Forests and Sea Power*, pp. 270–271.
[34] L. B. Chapman, "The Mast Industry of Old Falmouth," *Maine Historical Society Collections*, 2nd ser., VII (1896), 395.

1691, in the Massachusetts Charter, pines of a diameter of two feet or more were reserved for the Royal Navy, and were to be marked with a broad arrow, from which the conservation policy took its name. This policy was further strengthened by an Order in Council in 1699 and by legislation in 1711 and 1729.[35] Although ineffective because of the opposition of the colonists and the venality of some of the administrators, these measures were based on a fundamental principle of the policy of building up sea power — namely, that of securing a supply of cheap ships, which preferably should be built of domestic materials in home yards. The failure of the government of the United States to institute effective conservation policies later resulted in the growing timber famine of the mid-nineteenth century, and in a decline in the competitive advantage of American shipping. This early policy is significant, however, because it indicates an awareness on the part of the British government of the trends in timber depletion and their implications.

A few other sources of supply were also available to western European shipbuilders, but the costs of procurement were relatively high. English yards received some supplies of oak and hardwoods from the eastern Mediterranean and Black Sea areas, and from the Danube valley.[36] Some timber was also secured from the tropical forests. These forests were an outstanding source, for in them there was a dense growth of hardwoods, much of which consisted of large-sized trees. Builders, however, knew little about the properties of many such woods during the era of wooden ships. Furthermore, many of these woods were very heavy and costly to cut and ship. Consequently, little use was made of the tropical supplies prior to the nineteenth century, although if steel had not superseded wood, they would undoubtedly be the chief basis of shipbuilding today. Most important was the famed teak, which was secured in India and near Sierra Leone in Africa. The first maritime timber in the world for use in both frames and planking, but especially in the latter, it was employed extensively in ship construction in India by both Indian and British shipbuilders during the eighteenth and nineteenth centuries. Although it was a heavy timber, considerable amounts were also transported to British yards during the nineteenth cen-

[35] Albion, *Forests and Sea Power*, pp. 248–269.
[36] Albion, *Forests and Sea Power*, p. 400.

tury, the cost of the long voyage being offset by the high timber duties established on Baltic timber during the French wars, and by the advantages resulting from the durability of the teak, which was twice as great as that of English oak. After 1815, teak was generally used as planking on first-class merchant ships built in Great Britain.[37] It was particularly useful in the construction of the composite ships of the mid-nineteenth century, which had iron frames, for it had no adverse reaction on iron, as had white oak.[38] The live oak of Florida and some of the other tropical trees of the Spanish West Indies also appear to have been employed in Spanish yards, but not on as large a scale. On the whole, tropical woods played a small role in shipbuilding. The shipbuilders of Northwest Europe were, therefore, largely limited in the importation of ship timber to the Baltic and the northeast coast of North America.

The cost of transporting American timber overseas was sufficiently great to be a severe handicap to European builders. In the American trade, timber supplied outward cargoes for colonial ships, many of which had been cheaply built for sale abroad, and homeward ones for British vessels. Great mast ships of 500 gross tons or more, which were able to carry as many as 100 large masts, and many of which were of colonial build, were used in the New England mast trade. Oak frame timber was usually hewn to standard shape before shipment. One novel idea designed to reduce costs consisted of the construction of big solid timber rafts, which were fastened together by means of chains and bolts, and were sent to sea with brig or ship rigs, but these were too clumsy to be very practicable,[39] although in 1770 one, the *Newbury*, arrived at London in the good time of twenty-six days from the Merrimack.[40]

Furthermore, the profits of the English and colonial merchants engaged in the timber trade were often large. Although there was considerable competition among merchants engaged in the private lumber trade, there were in the colonies a number of politically powerful timber merchants, such as Colonel Westbrook and John Wentworth, and in England firms such as those

[37] Statement of Clifford Wigram, *Report of the* [British] *Select Committee on Merchant Shipping* (1860), Parliamentary Papers, 1860, XIII, 18.

[38] Albion, *Forests and Sea Power*, pp. 35–36.

[39] Currier, p. 24; Scharf and Westcott, III, 2336–2337.

[40] Currier, p. 24.

of Taylor, Warren, Gulston, and Henniker, which secured large profits, particularly at the expense of the Navy. Thus the costs of supporting large shipbuilding industries in the countries of Western Europe, which were some distance from a primary base of supplies, and of developing merchant fleets and navies consisting primarily of such high-cost ships were considerable. Satisfactory estimates are impossible to secure, but certainly the disadvantages of building vessels at such distances from the raw material were great, once sufficient supplies of labor, tools, foodstuffs, and skilled leadership became available in the new well-forested regions. The cost of delivering Baltic timber in England was as high as twenty times its stump value,[41] and the multiplier must have been still higher for most American timber.

The flow of timber was also affected by the policy of enumeration. The maritime power of each of the rival powers of Europe depended largely on its ability to secure access to these overseas timber supplies. In this respect England, France, Holland, and Spain were roughly on the same footing so far as distance was concerned. Under a system of free trade it is therefore unlikely that any one of them would have secured a substantial advantage. British shipbuilders evidently secured special advantages, however, from the British control of the extensive oak and pine supplies of the British American colonies. The value of these resources was early recognized by the mercantilistic British government, with the result that in 1729 masts and ship timber were placed on the list of enumerated articles which could only be exported to England. This was in line with mercantilist policy, which was designed to increase the power of the state by monopolizing colonial raw materials for the benefit of national manufactures. The policy must have had the effect of depressing the prices of masts and timber in the colonies, making England an entrepôt, and decreasing the rate of depletion. Thus the costs of shipbuilding within the British Empire were reduced, the competitive position of British shipping was improved, and the transport relations of the British Isles were bettered. Only the timber owners were injured. Actually, however, the policy of enumeration was probably of only minor importance, for much ship timber was shipped to France, Spain, Portugal, and Holland in violation of regulations. Furthermore, the existence of the Baltic supply

[41] Albion, *Forests and Sea Power*, p. 103.

placed definite limits on the advantage in price which British yards could secure. The capture of New Amsterdam in 1664 and of Canada a century later were, nevertheless, significant blows at the maritime power of Holland and France, for these powers were thus deprived of important timber preserves and colonial shipyards.

3

The timber resources of the New World influenced the localization of the shipping industry and the development of navigation in a much more significant way through the establishment of strong shipbuilding industries in the colonies, especially in those of England. Because of the theories of national defense and political economy then prevalent, the western powers of Europe were unwilling to permit the purchase of large numbers of vessels in Danzig, Stettin, Memel, and Riga, and other ports of the Baltic coast, which were the natural shipbuilding centers of Europe, despite the attractions of the lower prices there prevailing. No serious objections were made, however, to the development of shipbuilding in the colonies. Consequently the favorable economic conditions for shipbuilding soon attracted shipbuilders to America in large numbers and especially to the northern English colonies, where, indeed, the industry became foremost among the industrial employments then available to settlers. The development of the business, therefore, proceeded rapidly as immigration into the colonies increased and groups of skilled shipwrights became established along the coast. By the fourth quarter of the seventeenth century, the industry was, indeed, sufficiently well established to play a significant role in the development of the British merchant marine.

The records of British colonial shipbuilding are probably incomplete, but it is evident that the industry sprang up as rapidly as settlement permitted. The building of merchant ships in the colonies was encouraged by colonial officials, proprietors, and merchants. Even a few warships were laid down for the Royal Navy during the seventeenth and eighteenth centuries. The English shipbuilders were keenly aware of the potential danger of severe competition from the colonial builders, but were fortunately unable to prevent the admittance of colonial-built vessels to British registry. Hence the industry developed in the colonies without hindrance.

Until the fourth quarter of the seventeenth century, ship construction was undertaken mainly to provide vessels for the fishing business, the coastwise carrying trades, and the operations of the colonial governments. The shipbuilding industry was at first scattered along the coast, was conducted in an irregular manner, and was designed to meet the immediate needs of the colonists, rather than to provide ships for the general ship markets of England and the colonies. The first vessels to be built were the 30-ton ship *Virginia*, which was launched on the Kennebec in 1607 and later sailed to England and entered the service of the Virginia Company,[42] two vessels for Bermudian owners, which were built in Virginia in 1610, two shallops and two ketches which were built at Plymouth in 1624, and Governor Winthrop's 30-ton ship, *Blessing of the Bay*, which was constructed at Medford in 1631.[43] Vessels were also built at Bermuda, where a good grade of cedar was to be had.[44] The first substantial permanent activity probably resulted from establishment at Salem in 1629 of six competent master builders by the Massachusetts Bay Company, to whom were given land grants and other favors.[45]

Fishermen probably also engaged in shipbuilding to a considerable extent. Fishing soon became a major colonial industry. Even before the end of the sixteenth century, England alone was sending over 200 vessels to the Grand Banks, and by 1602 the shore fishery of the New England coast had been discovered. Bases were commonly established along the coast by these fishermen, and here vessels were built and repaired.[46] For instance, on small Richmond Island, near Portland, Maine, a bark of 30 tons, the *Richmond*, was built by John Winter in 1637 for the account of a Dorchester fishing enterprise, the instructions, ironware, and equipment having been sent out from England.[47] Fishing vessels were possibly built here as early as 1620, and construction continued as late as 1642.[48] There are also records of construction at other fishing centers, notably at Gloucester in 1623, Marblehead

[42] C. M. Andrews, *The Colonial Period in American History*, I (1934), 92.

[43] Hall Report, pp. 48–49.

[44] H. I. Chapelle, *The Baltimore Clipper, Its History and Development* (1930), p. 9.

[45] G. F. Chever, "The Commerce of Salem from 1626 to 1740," *Essex Institute Historical Collections*, I (1859), 72–73. (This source is hereafter cited as *E.I.H.C.*)

[46] Andrews, I, 94–95.

[47] Trelawney Papers, *Documentary History of the State of Maine*, III (1884), 85, 109, 136, 140, 144.

[48] Rowe, p. 7.

in 1634, and Portsmouth in 1635. The fishing vessels built in America during this early period were usually small and were frequently not decked over. Hence they were relatively unimportant craft. Nevertheless, the experience gained in building such craft proved to be valuable in later operations.

In the latter half of the eighteenth century the shipbuilding industry began to assume a position of greater importance. Shipyards able to turn out fair-sized craft for the colonial and European markets rose at many points. A considerable demand for tonnage for the rising shipping and fishing industries, which were fundamental elements of the colonial economy, particularly in the North, was a stimulating force. Numerous skilled journeymen and master builders immigrated from England, both to take advantage of the favorable conditions for shipbuilding and to avoid the religious and political struggles then raging at home. These master builders soon trained a number of workmen and apprentices. The size and quality of colonial-built vessels consequently improved. Ketches for the fishing fleet, topsail schooners, brigs, and sloops for the growing coastwise trade, and large ships and barks to carry colonial timber, fish, and other produce to Europe and the West Indies began to appear in large numbers.[49] In addition, as soon as competent master builders were available and suitable yards were established, a profitable business arose in the construction of ships for the rising merchant marine of Great Britain.

New yards were established during this period all along the deeply indented shoreline from the Province of Maine to Virginia. Salem early became an important center of ship construction, and a ship of 300 gross tons was built there by Richard Hollingsworth as early as 1641.[50] A vessel of this size was then comparatively large. By the close of the century, the business was on a firm commercial basis at this port. There were at least four important yards in operation between 1659 and 1677, and seven between 1692 and 1718. Among the latter, those of Joseph Hardy and William Becket were particularly notable.[51] As many as eight seagoing ships were to be seen on the ways here at one

[49] Andrews, I, 515–516.
[50] Chever, p. 73n; Andrews, I, 513.
[51] W. Leavitt, "Materials for the History of Shipbuilding in Salem," pt. I, *E.I.H.C.*, VII (1865), 207; Chever, p. 80.

time. In the port of Boston shipbuilding also became a leading business after 1640. Many yards here were soon engaged in the construction of vessels for both the domestic and foreign trades. Freighters had been built for Matthew Craddock, a merchant of London, on the Mystic River near Medford as early as 1634.[52] In 1642 a ship of 200 gross tons, the *Trial*, which was employed in the foreign trade, was built on Boston harbor, and in 1845 a still larger vessel, the *Seaforth*, of 400 gross tons, was completed.[53] One of the leading builders was Benjamin Gillam of Copps Hill. Another, Francis Willoughby of Charlestown, a builder of large ships, was able to cut timber on the town common.[54] By 1700, the shores at Boston, Dorchester, Milton, Quincy, Hingham, and Charlestown each contained one or more yards. "We are in a way of building ships of an 100, 200, 300, and 400 tons. Five of them are already at sea, and many more of them in hand at present," wrote an observer in 1642.[55] According to Hall's tabulation, 230 full-rigged ships, totaling 24,449 tons, were built in this port area between 1695 and 1714.[56] On the Merrimack River yards were also in operation at Newbury, near the mouth, before 1670; at Rowley on the Parker River, a branch of the Merrimack, by 1680; at Carr's Island in mid-stream by 1683; and upstream at Amesbury, Bradford, and Haverhill by 1700. Probably over 130 vessels were built on this river between 1680 and 1714.[57] Near-by Ipswich also built vessels as early as 1668. A few miles farther northeast, the Piscataqua River, the center of the ship-timber trade, also became a center of shipbuilding activity, particularly at Portsmouth and Exeter, beginning as early as 1651.[58] Vessels were also occasionally built in Maine at York, at Falmouth and other Casco Bay towns, on the Kennebec River, and at Pemaquid and Bristol, but until the nineteenth century, shipbuilding in Maine, which was a frontier region and was sparsely settled, was comparatively unimportant. A large ship is said to have been constructed by Sir William

[52] G. F. Dow, *The Sailing Ships of New England*, ser. III (1928), p. 8.
[53] Andrews, I, 513.
[54] R. Frothingham, *History of Charlestown, Mass.* (1845), p. 104.
[55] Dow, *The Sailing Ships of New England*, ser. III, p. 9.
[56] Hall Report, pp. 50–59.
[57] Hall Report, pp. 50–59; Currier, pp. 12–20.
[58] Adams, p. 70; C. H. Bell, *History of Exeter* (1888), pp. 336–337; Defebaugh, II, 126–127.

Phipps in the years 1675–76 on the Kennebec River, which was later to be the primary American shipbuilding center.[59] Messrs. Clark and Lake also operated a yard here between 1658 and 1676, at which from twelve to fifteen vessels were built.[60] There was as yet no need, however, to brave the hard winters of Maine and the dangers of the Indians in order to secure good timber, and the period of expansion was consequently a century away. Thus at Boston and along the coast to the northeast a considerable number of yards were in operation by 1700.

South and west of Boston, the industry was also established in scores of ports. Particularly prominent were the North River towns — Hanover, Pembroke, and Scituate; the Plymouth Bay towns — Plymouth, Duxbury, and Kingston; and the Narragansett Bay settlements. The North River of Plymouth County was a short, narrow, tidal stream or creek situated a few miles north of Plymouth in a rich oak country. The towns through which it flowed were to be, nevertheless, among the leading shipbuilding centers of the nation until the local timber supply there began to fail soon after the Revolution. Construction here is said to have been begun by Edward Wanton, who came from London in 1670.[61] By the end of the seventeenth century as many as five full-rigged ships, and many brigantines and sloops were built annually at these yards. At Plymouth building also began at an early date. Edward Banks built a 50-ton vessel there as early as 1641.[62] Thereafter, until early in the nineteenth century, deep-sea sailing ships came forth in large numbers from the yards of Plymouth and the neighboring towns. In the Narragansett Bay area at least 103 vessels appear to have been built between 1698 and 1708, the important centers being Providence, Dighton, Taunton, and Newport. Only ten of these vessels, however, are listed as full-rigged ships.[63] Many were vessels for the thriving West India trade and for the coasting and peddling trades, which chiefly required shallow-draft sloops and schooners.[64] There was also shipbuilding along the Connecticut shore,

[59] P. McC. Reed, pp. 136–137.
[60] H. W. Owen, *History of Bath* (1936), p. 465.
[61] Briggs, p. 214.
[62] W. L. Marvin, *The American Merchant Marine* (1902), p. 3.
[63] Hall Report, pp. 50–59.
[64] Defebaugh, II, 294; Edward Field, *The State of Rhode Island and Providence Plantation at the End of the Century, a History*, 2 vols. (1902), I, 168–169, 177.

but it was mainly confined to small craft until well into the eighteenth century.[65] Thus the maritime industries were also well established in this area by the end of the seventeenth century.

There was some ship construction outside of New England. The Delaware River colony became an important shipbuilding center shortly after its founding in 1682, for William Penn, influenced by the success of the New England yards, carefully included skilled builders and craftsmen among the first settlers.[66] In 1685 there were three yards in the colony, and during the following century large numbers of ships, brigs, and ketches were launched, many of which were of a high quality of construction.[67] Many of these were sold in England and the West Indies. There was also some shipbuilding at New Amsterdam, where the Dutch West India Company established a yard. As early as the years 1613–1614 Adriaen Block, a Dutch explorer and shipmaster, had built a small 16-ton "yacht," or exploring vessel, upon the upper reaches of the river.[68] The Dutch shipyards in New Netherland were not effectively developed,[69] however, doubtless because of the renowned efficiency of the shipbuilding industry in Holland, the low cost of transporting timber to Holland from the Baltic, and the lack of a supply of skilled shipyard labor along the Hudson. Indeed, it was not until a later period, the early years of the nineteenth century, that New York shipbuilders achieved a position commensurate with the advantages of their location on the well-timbered Hudson. There was little building in the other colonies. In Virginia the profitability of agriculture, and especially of tobacco farming, prevented the development of any more substantial shipbuilding activity than the construction of shallops for the coastwise trade, despite the efforts of the royal governors to promote the industry.[70] New England was, therefore, during the seventeenth century the foremost colonial shipbuilding region.

[65] Andrews, II (1936), 125, 175–176; Hall Report, p. 48.
[66] Gillingham, p. 156; C. L. Chandler, *Early Shipbuilding in Pennsylvania, 1683–1812* (1932), p. 12.
[67] "The Ship Registers of the Port of Philadelphia, 1726–1775," *Pennsylvania Magazine of History and Biography*, vols. XXIII–XXVIII (1899–1904).
[68] Andrews, III (1937), 71; Hall Report, p. 46.
[69] Hall Report, pp. 48–49.
[70] Andrews, I, 139, 152, 210.

4

Although the statistics of colonial shipbuilding are highly unsatisfactory, there is abundant evidence that a rapid growth took place during the eighteenth century prior to the Revolution. For example, in New England the recorded output consisted of 13,435 gross tons in 1769,[71] compared with an average of 2931 gross tons for the years 1700–1704.[72] At Philadelphia, the output was 458 gross tons in 1722, typically about 700 gross tons per year between 1726 and 1735, and 2354 gross tons in 1770.[73] Reports of great activity remain from many other ports. As many as thirty large ships are said to have been completed annually at Boston during the middle of the century. On the little North River there were about twenty builders at the close of the colonial period. The Merrimack River is said to have been a continuous shipyard just prior to the Revolution, some seventy-two craft having been turned out in the year 1766 alone.[74] One builder there, Gideon Woodwell, is said to have constructed fifty-two vessels by 1776, and it is likely that many others had similar records. At about the same time from the Piscataqua from ten to thirteen vessels were sent yearly to England for sale, and many others were built there for local owners.[75] It is evident, therefore, that in the more important centers shipbuilding had become a substantial industry by the eve of the Revolution.

The shipbuilding industry was also established and developed in many new towns. Output increased notably in Maine, where new firms arose. As early as 1742, as many as forty square-rigged vessels were said to be building in the province, chiefly in the southwest.[76] Shipyards were first set up at Kennebunk on the Mousam River in 1745, and on that great shipbuilding river, the Kennebunk, in 1755, when a topsail schooner was built at Arundel.[77] Building was reëstablished on the Kennebec by

[71] *An Account of the Number and Tonnage of Vessels Built in the Provinces, 1769, 1770, 1771*, Journal of the House of Commons, 1792, p. 356. Probably both the figures mentioned should be increased by 50 per cent to obtain the correct totals due to the failure of the officers to measure vessels and the resulting understatement of their size.

[72] Tabulation of the New England Registers, Hall Report, pp. 50–59.

[73] "The Ship Registers of Philadelphia"; see Scharf and Westcott, III, 2336.

[74] Currier, pp. 21–24.

[75] Adams, p. 258.

[76] Charles Bradbury, *History of Kennebunkport* (1837), p. 143.

[77] Daniel Remich, *History of Kennebunk, from its Earliest Settlement to 1911* (1911), pp. 168–172.

J. Philbrook in 1742, by J. Lermont in 1745, by David Ring in 1760, and later by others.[78] A big yard for the construction of ships for foreign firms was opened by William Swanton in 1762.[79] Jacob Bailey wrote in 1764 that "the banks of the Kennebec, which five years ago were covered with impenetrable forest and almost destitute of inhabitants are now adorned with pleasant fields, some stately buildings, and a multitude of people," and that "shipbuilding multiplies apace." [80] By 1780 at least twenty ships, seven schooners, and seven sloops had been built at Bath.[81] Shipyards also arose on the upper reaches of the Sheepscot, Damariscotta, and St. George rivers and in other "down-east" towns. As early as 1740, George Barstow of Hanover began construction at Newcastle, where many great ships were later built.[82] Vessels were built here for Salem and Boston firms. At Warren on the St. George River Hugh McLean founded in 1762 the first of the great Warren and Thomaston yards.[83] At Ellsworth a period of shipbuilding activity began in 1773 with the building of a West India lumber schooner, a type of vessel commonly found on the ways in Maine.[84] Shipbuilding also began at various ports to the eastward, for example, at Mount Desert about 1800, at Blue Hill about 1815, and at Camden in 1806.[85]

Along the Connecticut shore activity increased considerably, notably in the Connecticut River towns of Hartford, Portland, Middletown, Haddam, and Essex, and at New London, New Haven, and Derby.[86] Three warships of the Continental Navy, the *Trumbull*, thirty-six guns, *Bourbon*, forty guns, and *Connecticut*, twenty-four guns, came from the Connecticut River yards, and this attests the ability of the builders in this region.[87] Rhode Island became a builder of shoal-draft sloops and schooners of from 20 to 80 tons for trading voyages to the southern plantations.[88] Construction in the Chesapeake Bay region also sprang

[78] Owen, p. 465; Lermont, p. 5.
[79] Owen, p. 465.
[80] Letter to John Gardner, November 13, quoted in C. E. Allen, *History of Dresden, Maine* (1931), p. 739.
[81] Owen, p. 479.
[82] Cushman, p. 329.
[83] Cyrus Eaton, *Annals of Warren* (1851), 2nd ed., 1877, pp. 128–129.
[84] A. H. Davis, *History of Ellsworth* (1927), p. 114.
[85] J. L. Locke, *History of the Town of Camden* (1859), p. 223.
[86] Middlebrook, I, 204.
[87] Middlebrook, I, 204.
[88] W. F. Crawford, "The Commerce of Rhode Island with the Southern Continental Colonies in the Eighteenth Century," *R. I. Hist. Soc. Coll.*, vol. XIV (1921), no. 4, pp. 108–109.

up, the yards of Baltimore, in particular, becoming noted for their excellent models and construction.[89] Building does not, however, appear to have been active in the first half of the century. The first recorded vessel built was the sloop *Baltimore Town*, thirty-six tons, constructed in 1746.[90] All told, colonial construction probably did not exceed 4000 gross tons in 1700, whereas it averaged about 35,000 gross tons in the period 1769–1771.[91]

The vessels built in colonial yards were generally of small size, the majority being small sloops and brigantines for the important coastwise trade, ketches and small craft for the fishery, and brigantines, brigs, and full-rigged ships for the West India and European trades and for sale in England. Occasionally large ships, which in that period measured between 200 and 400 tons, were constructed for both colonial and English owners. The shipbuilders rarely undertook, however, to build vessels of the highest class. Although in 1696 royal frigates were built at Portsmouth,[92] and occasional warships were later laid down, few really big ships were built. Colonial-built ships unfortunately possessed a bad reputation abroad for poor construction and for rapid decay because of the use of green timber by the colonial builders.[93] It may be concluded, therefore, that although the type of vessel built was small and undistinguished and the construction was not always first class, the shipbuilding industry at the end of the colonial era had become fairly well developed.

5

Colonial-built ships were sold at remarkably low prices during the eighteenth century. The advantage in cost of the North American builders compared with those of Europe was probably at a maximum at this time because of a plentiful timber supply and the development of the bog iron industry. Some measures of this differential are available. In 1700, Governor Bellomont wrote that "at Boston they pretend to build marchand ships 40

[89] Chapelle, *The Baltimore Clipper*, p. 14.

[90] R. M. Bibbins, "The City of Baltimore, 1797–1850, the Clipper Ship, Mill and Railroad," in C. C. Hall, *The History of Baltimore*, 3 vols. (1912), I, 68.

[91] *An Account of the Number and Tonnage of Vessels Built in the Provinces, 1769, 1770, 1771*, Journal of the House of Commons, 1792, pp. 356–357. The official figures have been increased by 50 per cent to make correction for undermeasurement.

[92] Albion, *Forests and Sea Power*, p. 244.

[93] Albion, *Forests and Sea Power*, p. 246.

per cent cheaper than they could be built in England." [94] Ninety-one years later, Tench Coxe found that a similar price ratio prevailed, the best American ships being sold at a price of about $34 per ton compared with prices of from $55 to $60 for the best English ones.[95] During the colonial period prices of vessels built in North America generally ranged between £3 and £4 per ton, compared with prices of from £5 to £7 for English-built ones. It is not surprising, therefore, that the colonial shipbuilding industry prospered.

One result of this situation was that British owners bought ships in the colonies in large volume. One of the first was an enterprising London merchant, Matthew Craddock, who had several vessels built in the Boston area in 1634.[96] In 1676 it was said that as many as thirty large ships were built annually for British account in New England,[97] and in 1718 extensive construction for the same market was reported in Philadelphia.[98] The registers of Philadelphia indicate the sale of from three to twelve ships and brigs yearly to English owners during the later colonial period.[99] Officials stated in 1721 that the larger part of the colonial output was for English account.[100] The New England records for the period 1674–1714 show that of the 1332 vessels of thirty tons or more documented, 239 were for European or West Indian account;[101] but these figures probably underestimate the sales because of the practice of building ships on speculation and sending them on one or two voyages before sale. The absence of large numbers of British-built vessels on colonial registers also indicates that the colonial builders forced their British rivals out of their home market. For example, in New England from 1695 to 1714, of the vessels documented, 75,475 tons were colonial-built and only 775 tons were British-built;[102]

[94] Report of Governor the Earl of Bellomont to the Council on Trade and Plantations, Cal. S.P.A. & W.I., XVIII (1700), 680.

[95] *A Brief Examination of Lord Sheffield's Observations on the Commerce of the United States* (1791), p. 83.

[96] Dow, *The Sailing Ships of New England*, ser. III, p. 8.

[97] V. S. Clark, I (1916), 95.

[98] J. L. Bishop, I, 70–71.

[99] "The Ship Registers of Philadelphia."

[100] V. S. Clark, I, 95.

[101] Computed from the lists given in the Hall Report on the Shipbuilding Industry, pp. 50–59. One hundred sixty-nine vessels were for English account.

[102] Computed from figures in the Hall Report, pp. 50–59.

and of those documented at Philadelphia from 1736 to 1745, 14,680 tons were of colonial build and only 130 tons were of British build.[103] The colonial yards thus apparently had a very great competitive advantage.

Vessels were built for British account both on order and on speculation. British firms often instructed their agents to use the proceeds from the sales of outward cargoes in the construction of ships, and frequently sent out the sails and equipment. Agents were usually instructed to supervise construction on a commission basis.[104] When finished, the ships were sent home to England loaded with colonial cargoes, either directly or by way of the West Indies. Freights were relied upon to pay the costs of delivery. Many vessels were also built each year on speculation by colonial merchants and shipbuilders, and were sent to the chief British maritime centers in Europe and the West Indies to be sold.[105] Builders in nearly all of the ports participated in both types of business.[106]

It is important to inquire into the extent to which the shipbuilding industry in the colonies promoted the rise of British shipping and improved British transport relations, thus aiding the general economic development of the country. Careful consideration of this point leads to the conclusion that the large-scale construction of merchant ships in the colonies was a primary factor making possible successful competition with foreign vessels. Indeed, it probably made the British navigation monopolies more bearable to the merchants, especially to those engaged in the West Indian and American trades. The colonies apparently provided British shipowners with vessels at prices comparable to or below those charged by Danzig, Stettin, Memel, and Hamburg firms. The advantage of the low ship prices prevailing in the colonies was, however, mainly secured by British owners alone. Few British colonial-built vessels passed under foreign flags because of the rigid registry laws of other nations. Hence the constant influx of colonial-built ships into the British market depressed vessel prices there. The complaints of the English ship-

[103] Computed from "The Ship Registers of Philadelphia."

[104] Gillingham, pp. 168–170.

[105] V. S. Clark, I, 95; L. S. Mayo, *John Langdon of New Hampshire* (1937), p. 27.

[106] Chever, p. 86n; Adams, p. 258; P. McC. Reed, p. 140; Currier, pp. 20–21, 26.

builders are an indication that this was the effect. The result must have been beneficial to the shipping industry of England.

The volume of tonnage secured from colonial America appears to have been very substantial. An indication of this is the fact that as early as 1700 the colonial merchant marine amounted to one thousand vessels,[107] many of which were employed in the important carrying trades of the Empire. By the time of the Revolution the number of "colonial-builts" under British registry was 2343, or a fourth of the total by number.[108] By tonnage the proportion was probably a little greater, for in 1774 that of colonial build on British registers was put at about 210,000 tons, compared with a total fleet of about 600,000 tons.[109] Indeed, as late as 1790, 424 American-built ships, measuring some 101,000 gross tons, remained on the British register, although nearly a wooden ship's lifetime had elapsed since the Revolution had interrupted the supply.[110] American-built vessels were used in almost every trade of the Empire, with the exception of that to India. Hence the extension to the United States in 1786 of the registry provisions of the British Navigation Acts which prohibited the documentation of foreign-built vessels was a major blunder in British economic policy.[111] Although shipbuilding developed in Canada and India in the nineteenth century, the closing of the British market to American shipbuilders effectively prevented the British merchant marine thereafter from securing a large supply of good, cheap ships, and thus arrested its development.

The fact that none of the other principal maritime powers was able to establish a successful shipbuilding industry in its colonies was a factor of major importance. The Dutch lost their valuable shipbuilding region on the Hudson in 1664. Little had been built here, however, for, although the small yacht, the *Onrust*, had

[107] Albion, *Forests and Sea Power*, p. 246.

[108] Albion, *Forests and Sea Power*, p. 246, citing *Lloyd's Register, 1775–1776*; David Macpherson, *Annals of Commerce, Manufactures, Fisheries, and Navigation*, III (1805), 563.

[109] Usher, "The Growth of English Shipping, 1572–1922," p. 467.

[110] *Account of the Number of Vessels, with their Tonnage, belonging to Great Britain, 1788, 1789, 1790*, Journal of the House of Commons, 1792, p. 355. The recorded figure of 67,346 tons has been corrected by the addition of 50 per cent.

[111] 26 Geo. III, c. 60; for a discussion of the circumstances leading to the passage of this act see John Reeves, *History of the Law of Shipping and Navigation* (1792), pt. III, chap. vi.

been built in the years 1613–14, and the Dutch West India Company had later set up a .yard, it was impossible to secure during these early years a sufficient labor supply to enable much construction to be started. The French also were prevented by a scarcity of labor from making the rich resources of Nova Scotia, New Brunswick, and Quebec the basis of an active industry, despite the early efforts of Colbert. The first vessel to be built in New France was probably launched at Port Royal in 1606.[112] Small craft were thereafter occasionally built for fishing and coasting. On the St. Lawrence the intendant at Quebec built a large ship there as early as 1663, but it was not until the nineteenth century that the river was to become a river of shipyards. The Spanish possessions also failed to develop an active industry, although vessels were occasionally built at Havana, Panama, Mexico, Santo Domingo, and Porto Rico. The yards at Havana constructed Indiamen and frigates, as many as six having been built in 1590.[113] At Panama the Pacific plate fleets were constructed, beginning in Balboa's time.[114] Nevertheless, although the resources of ship timber of the Spanish colonies were abundant, regulation, royal monopolies, the lack of skilled labor, and the existence of other more favorable roads to fortune prevented the rise of a large industry. Despite these difficulties, a considerable portion of the Spanish tonnage was obtained from the West Indies during the seventeenth century, when the timber situation had become comparatively unfavorable in Spain. For instance, in the annual Seville plate fleet of 1610, forty ships of 18,780 tons were Spanish-built, and twenty ships of 5,975 tons were colonial-built.[115] From 1642 to 1644 all the ships of the fleets were colonial-built. Spanish "colonial-builts" were comparatively costly, however, despite the excellent hard woods of the Spanish Main, the cost reflecting the influence of gold production and the lack of a good labor supply. It was impossible for them to compete effectively with the products of the British colonial shipyards. The Dutch, French, and Spanish merchant marines were therefore deprived of sources in America of cheap ships.

Thus we may conclude that, until the Revolution, the development of British shipping and communications was greatly stimu-

[112] Wallace, *Wooden Ships and Iron Men*, p. 8.
[113] Haring, p. 268.
[114] Haring, p. 267.
[115] Usher, "Spanish Ships and Shipping," pp. 203–205.

lated by the rise of a low-cost shipbuilding industry in the overseas colonies. Had policies of free trade and free purchase prevailed, the fact that resources for shipbuilding were abundant would have had little influence on the localization of the shipping industry. Under the policies of mercantilism, however, access to a supply of cheap ships and shipbuilding materials were basic conditions for the development of national shipping industries.

6

The shipping industry, like that of shipbuilding, played an important role in British colonial life, although it never rivaled the latter as an export business. Colonial shipping was mainly employed in the coastwise and direct overseas carrying trades of the colonies, and in the cod fishery of the Grand Banks, which were visited by New England fishing craft beginning about 1615.[116] After 1640, vessels ranging in size from open shallops to 400-gross-ton ships were secured by colonial owners. The mercantile and seafaring elements in the population also notably increased, especially in Massachusetts.

The fishing business and the commerce in fish were especially important. As early as 1696 Salem, the rising maritime metropolis of Massachusetts, was sending some sixty ketches, ranging from twenty to forty tons in size, to the fishing banks.[117] This fish, and the lumber of many ports, provided the staple export cargoes. The fish was dried and graded, and then exported, sometimes in the vessels in which it was caught. The poorest grade went to the sugar plantations, and the best to the Iberian Peninsula. The vessels sometimes stayed out fishing on the banks, on the Labrador coast, or in the Gulf of St. Lawrence, for a month or two.[118] Big fleets were registered during the eighteenth century, not only at Salem, but also at Newburyport, Portsmouth, Gloucester, and other eastern centers. In general, the fishing business was very economically conducted in New England and yielded profits which were often handsome.

Trading voyages were made along the coast from Virginia to

[116] Dow, "Shipping and Trade in Early New England," *Proc. Mass. Hist. Soc.*, LXIV (1930–32), 186–191.

[117] Chever, pp. 82–85, 122, 167.

[118] Lorenzo Sabine, *Report on the Principal Fisheries of the American Seas* (1853), House Exec. Doc., no. 23, 32 Cong., 2 Sess., pp. 169–188.

Newfoundland, and overseas to England and the Continent.[119] London, Bristol, Dublin, Amsterdam, La Rochelle, Bordeaux, Marseille, Malta, Bilbao, Lisbon, Malaga, Barcelona, and Leghorn were among the important European ports at which colonial ships touched.[120] Most important, however, was the trade with the British West Indian sugar colonies of Barbados, St. Kitts, Antigua, and Nevis, which provided an outlet for the fish, beef, corn, and lumber of the continental colonies, and provided a supply of sugar, molasses, and rum.[121] Ships of all sizes and rigs, and enterprises of all kinds and sizes, found profitable employments in trading, peddling, and carrying in the West Indies. There was also much peddling of produce along the American coast. Larger speculations were undertaken by merchants who sent cargoes and ships to Europe. Then there was the standard triangular voyage from the continental colonies to the West Indies with lumber, fish, grain, or other provisions, thence with sugar to England, and thence homeward with manufactured articles. The British Empire itself provided a wide field for the colonial skipper, and, in addition, there were other routes. The leading ports — Salem, Boston, Newport, and Philadelphia — became centers for the reëxport trade, which arose as a result of the ubiquitous operations of many small sailing craft. The operation of traders and tramps was thus an important and profitable business in colonial days.

The colonial shipping industry, unlike the colonial shipbuilding industry, appears to have secured no important advantage in costs of operation. Colonial shipping was mainly employed in the commerce of the colonies, and much of it was owned by merchants who used their vessels for their own purposes. English or other foreign vessels were sometimes chartered,[122] however, indicating that merchants did not always find it desirable to buy or hire colonial craft. The prices of colonial-built ships were approximately the same to both English and colonial owners, and there was little difference in labor costs between the two areas. But the development of colonial shipping was hampered by a shortage of capital, and accordingly it became common for English firms to buy either a majority or a small quantity of the shares of the vessels employed in colonial commerce. Thus colo-

[119] Andrews, I, 515.
[120] Andrews, I, 515.
[121] Andrews, I, 515–516.
[122] Andrews, I, 516.

nial shipyards supplied most of the vessels, colonial merchants provided much of the entrepreneurial talent, and the ships were manned with colonial seamen; but English firms supplied a large part of the capital required to maintain the ocean transportation system of the colonies. This was, in fact, a most advantageous international division of labor.

7

The shipping industry at this time was organized as a small-scale business. It was necessary, therefore, to devise navigation policies suitable for the protection and control of many small private firms which were engaged in operating ships in many diverse types of services. Indeed so firmly was the small firm established that the granting of special monopolistic privileges, such as those accorded to the British East India Company, appears to have been necessary to cause the rise of large-scale organization.

There were several reasons for the predominance of small firms. First, the ocean-carrying trades were not concentrated on certain sea routes so much as they are today. Instead, shipping enterprise was dispersed among a large number of ports, and cargoes were loaded and discharged in many places. There was comparatively little concentration of export shipments prior to loading, and on arrival cargoes were not widely distributed. The absence of railroads, the poor state of the highways, and the slow development of canals and river works made the concentration of cargoes uneconomical. Furthermore, since agriculture and the handicraft industries were widely dispersed, for the centralizing influence of coal deposits and power supplies had not yet been felt, the demand for shipping services was decentralized. Therefore, each port and waterway was the focal point of the traffic of its own small hinterland. This was particularly true of the British colonies in North America, where the overland transportation system was poorly developed. It was also true of the British Isles, Europe, and the Far East. In the carriage of traffic of this kind, small vessels, which could easily enter port and reach docks of shallow depth and could readily and quickly handle small shipments, were most desirable. It was pointed out early in the nineteenth century, for instance, that the small American ships operating in the East Indies had a great advantage over

the ponderous craft of the East India Company because of their ability to enter small ports easily without the need of waiting for pilots and favorable winds. The shipmasters could quickly transact their business and depart. The small sailing ship was, therefore, the ideal type of vessel for trade. Ships of a size as large as 400 gross tons were looked upon both in Europe and the colonies as being too large for successful operation, and ships as large as 800 tons were considered to be white elephants. Thus schooners, sloops, and square-rigged vessels of from 150 to 300 gross tons were the typical types of craft employed in the offshore trades. The small size of these vessels clearly promoted small enterprises.

Secondly, there were not likely to be substantial economies or other advantages of large-scale business in ship operation during this period. General cargo movements were too irregular, trade was too widely dispersed, and the time required to make passages was too uncertain to make profitable the operation of shipping lines consisting of numbers of vessels sailing on a given schedule. Hence, with the exception of vessels employed in local services, all ships were tramps or private traders. Each vessel was operated as an independent unit. Many were owned by merchants and were employed primarily in their own trading operations. This was particularly true of the ships sailing from the British colonies, which were employed by merchants engaged in the lumber, fish, and provision export trades, and in European and West Indian trading operations generally. Ships were comparatively unspecialized, and it was possible to use fairly large craft in succession for various freighting operations, fishing, and even whaling. Entry into the business was comparatively easy, for only a small amount of capital was necessary to purchase one of the small schooners, sloops, or brigantines which were continually offered on the market. The shipping industry during the period of mercantilism consisted, therefore, primarily of a large assortment of small firms engaged in various trading, peddling, and tramping operations.

8

The navigation policies which were most prominent in the age of sailing ships were mainly developed during the first period of intense nationalism, which lasted from the Renaissance to the

middle of the eighteenth century and is known as the age of mercantilism. Their roots were to be found in the endeavors of the rival national states to expand and become more powerful. This period was of tremendous importance in the development of the shipping industry of Europe. The improvements which had been made in the designs of hulls and rigs had permitted the construction of seaworthy vessels able to keep the sea for weeks, if necessary, and able to navigate with some degree of independence of weather conditions. The voyages of the Portuguese navigators Diaz, Vasco da Gama, and Magellan, and of Columbus, the Cabots, and Drake proved this. The work of the geographers and mathematicians enabled seamen to secure new and better charts and maps. New opportunities for trading and settlement were opened up by the extensive discoveries in America and the Orient. The coastwise trade of Europe increased under the influence of rising production and a growing division of labor. Shipping became vital in the maintenance of communications with the colonial possessions of England, France, Spain, and Portugal. It also was essential for the development of the rising international trade in commodities. Hence it is not surprising that during this period comprehensive policies were evolved by the leading powers of Europe.

The nature of mercantilist navigation policy was determined by the general objectives of governments during this period. In general, statesmen had two primary objectives: to increase the relative political and military power, and to expand the wealth, population, and productivity of their respective national states. Wealth was sought, however, both for itself and as a means of increasing national power. During this period, indeed, the first comprehensive attempts to devise general national economic policies designed to promote national power and security were made in England, Holland, France, and Spain. A consideration in shaping all policies was the possibility of large-scale warfare. The rival powers constantly found themselves in conflict with one another in political matters, the development of colonial empires, and the pursuit of trade and commerce. Even when this was not so, economic warfare, which was waged by means of the establishment of import and export duties, the granting of subsidies to important industries, the discovery and monopolization of colonies, the development of protective navigation systems, and the

creation of trading monopolies, was the normal state of affairs. All policies were based on the assumptions that actual warfare was an ever-present possibility, and that discriminatory commercial policies were to be found generally. The problem of statecraft in the economic field was to organize the economy of each country so as to provide economic strength and security.

Navigation policy was but one of many policies applied by the mercantilist state to achieve its objectives. The shipping and shipbuilding industries, although comparatively small in size, stood near the top of the list of essential industries which it was felt deserved the special support of the state. This was especially true in England, where naval power and a secure ocean transportation system were particularly essential for the development of the British Empire and of England as a world power. Mercantilists did not hesitate to establish those industries which they deemed essential for the security of the state, even though economic conditions were unfavorable for their development.

The shipping and shipbuilding industries were especially prized by mercantilist statesmen because of their dual value as vital elements of the national defense and as tools for the extension of empire, the development of trade, and the securing of exclusive trading advantages and favorable terms of trade. The merchant ships of this period were extremely useful in war as privateers and even as warships. They also served to maintain large numbers of skilled seamen and gunners from which the crews of war vessels could be recruited in an emergency. In peace time the success of trading activities, as they were then conducted, was also greatly promoted by the ownership of vessels. Furthermore, national shipping was also a vital factor in promoting internal unity within empires and nations, for it provided a transportation system largely owned, manned, controlled, and defended by citizens. In many countries efforts were being made by the national governments to improve national internal transportation systems by abolishing tolls and other obstacles to commerce,[123] and by building roads and canals and improving rivers.[124] The policy of developing national shipping industries was complementary to that pursued in regard to internal transportation. The develop-

[123] Heckscher, I, 45–109.

[124] See Sven Helander, "Merkantilische Verkehrspolitick," *Weltwirtschaftliches Archiv*, Berlin, Bd. XLVIII (1938).

ment of a national shipbuilding industry was also considered essential to provide facilities and skilled workmen necessary for the building of warships and for the repair of fleets after damage was suffered in battle. It is not surprising, therefore, that a strong tendency toward autarchy in navigation policy arose.

Mercantilist economists gave considerable prominence to the shipping industry in their discussions. Sir Josiah Child, who as head of the important British East India Company was vitally interested in maritime affairs, pointed out with pride that the act establishing the highly protective British navigation system "in relation to trade, shipping, profit, and power is one of the choicest and most prudent acts that was ever made in England, and without which we had not now been owners of one-half the shipping, nor trade, nor employed one-half the seamen which we do at present."[125] Davenant wrote that merchant ships were a sign of enterprise, power, and wealth, and were perhaps more useful than any other type of investment.[126] Thomas Mun defended the economic activities of the British East India Company on the ground that it maintained many heavy vessels, shipyards and seamen.[127] Colbert, the active minister of Louis XIV and an important mercantilist, believed strongly that it was necessary to develop the French shipping and shipbuilding industries in order to make France secure. Even Adam Smith, who vigorously attacked the mercantile commercial policy in general, approved of the protective measures taken with respect to British shipping and shipbuilding. He wrote: "They are as wise as though they had been dictated by the most deliberate wisdom. National animosity at that particular time (that of the Dutch Wars) aimed at the very same object which the most deliberate wisdom would have recommended, the diminution of the naval power of Holland, the only power which could endanger the security of England."[128] After Smith, however, the writings of the British and American economists became relatively silent on the subject of navigation policy. The views expressed by the mercantilistic writers, rather than those of the classical school, largely influenced navigation

[125] Child, p. 85.

[126] Charles Davenant, *Discourses on the Public Revenues and on the Trade of England* (1698), pt. II, p. 18.

[127] Thomas Mun, *A Discourse of Trade from England into the East Indies* (1621); reprinted 1930, p. 36.

[128] *Wealth of Nations*, Cannan Edition, I, 428–429.

policy during the nineteenth century. Although free trade swept away many crude protectionist policies, the shipping and shipbuilding industries continued to be a special concern of the major powers and citadels of protection. With the rise of nationalism again in the twentieth century, further strong measures were taken. Nationalistic navigation policies thus developed during the long period of mercantilism under strong influences, which never entirely disappeared, tending toward the establishment of highly-protected and self-sufficient systems of marine transportation.

9

The predominant technique employed to protect shipping during the age of mercantilism consisted of the establishment of navigation monopolies. In this way foreign tonnage was eliminated from competition with national vessels on many trade routes, thus allowing national shipping firms to fill in the gap and control the transportation of goods and persons. By means of such measures nations expected to secure numerous advantages. First, the expansion of the national shipping and shipbuilding industries might be expected to result if a large amount of foreign tonnage was eliminated and retaliation was ineffective. Sometimes the decline of the shipping industry could at least be prevented. Second, the routes of the imperial carrying trades could be centered in the mother country by the development of a national shipping industry. Third, the security of the transportation systems linking the mother country with the colonies and foreign nations could be increased. Fourth, the control of the carrying trade increased the economic advantages of national merchants in conducting trading operations, and the political and military power of the home and colonial governments and officials. Regulations forbidding, or at least limiting, the use of foreign tonnage in some trades gave national merchants protection in the conduct of operations as trading was then conducted. Therefore each state endeavored, so far as possible, to become self-sufficient in the matter of shipping services.

The most important of these mercantilist protective systems, and the one with which we are most concerned, was that created by the British navigation laws,[129] which were designed to promote

[129] 12 Car. II, c. 4 (1660); 13 & 14 Car. II, c. 11 (1662); 15 Car. II, c. 7 (1663).

the growth of the British merchant marine, and to assist in the establishment of a position of undisputed power on the sea. This system greatly protected the shipping of both Great Britain and her colonies until the Revolution. Thereafter, until the total abolition of the system in 1849, it contributed greatly to the protection and development of the shipping of the Empire. Because of the extent of the British Empire, and the importance of the many trade routes which could be monopolized, this system became the foremost example of this type of protection. The policy was essentially one of extreme self-sufficiency in shipping and shipbuilding, and it clearly caused the costs of ocean transportation to be raised. Nevertheless, it enabled the British government to achieve its objective of becoming a great sea power.

The policy was based on the assumption that the shipping industry of England was operating under an unfavorable cost differential with respect to that of other countries. The competition of the Dutch during the seventeenth century was particularly vexing, and the rise of the Dutch merchant marine was deemed to endanger the security of England. The Dutch, indeed, had reached a position in which their shipping was able to control much of the carrying trade of Europe. The exact causes of this remarkable advantage are difficult to determine. Apparently, however, the Dutch achieved marked success in building cheap and efficient freighters. The primary advantage probably lay in the fact that the Dutch secured good ship timber at a lower price than the English from the Rhine region of Germany and from the Baltic, from which latter area they were able to bring it at a lower cost because of the efficiency of their shipping. They also secured remarkable economies in shipbuilding. Large stores of ship timber were kept on hand to facilitate the process of ship construction. The workmen were highly skilled and numerous, and although they perhaps received higher wages than those in England,[130] their efficiency was greater because of the excellence of Dutch organization. The Dutch were also successful in building large cargo ships which, although lightly built of timber which was sometimes weak and brittle, nevertheless could carry larger cargoes and be navigated more economically than the corresponding English ships. It was said by Sir Josiah Child that they could be navigated by a third of the number of seamen, but this may be

[130] Andrews, IV (1938), 26.

an exaggeration. It is clear, however, that the Dutch shipbuilders, by virtue of greater efficiency, better timber supplies, and better designs, were able to construct extremely cheap and efficient ocean carriers.

The Dutch also achieved an advantage in ship operation. In part this superiority was due to the advantage which they possessed in shipbuilding, although it should be noted that prior to 1651 English owners succeeded in purchasing some of these vessels. Their shipping industry was, however, very efficiently organized, and apparently secured some advantages in competition as a result. Furthermore, the interest rate was considerably lower in Holland than in England. The shipping of Holland also enabled her merchants to secure trading advantages in numerous places. Dutch shipping consequently controlled many branches of the European long- and short-voyage carrying trades. The Dutch dominated the coastwise traffic from France, the Low Countries, and England to the Baltic and Russia.[131] In the Far East they secured trading stations and seriously competed with the English. Dutch shipping also played an important role in the commerce of America and the West Indies. In the Baltic and North Sea they secured a predominating position in the fisheries. Finally, their shipping activity, advantages in trade, and efficiency in shipbuilding enormously added to their naval power. In mercantile affairs they also showed a greater efficiency both at home and abroad in concentrating trade in their hands, accumulating capital, and increasing the scope of their operations.[132] Consequently English trade and shipping languished, and it was felt that the security of the country was threatened.

British navigation policy was, therefore, necessarily highly protective. The technique was two-fold: to erect as many navigation monopolies as possible to protect the shipping industry; and to require the construction of British ships in home or colonial yards. The policy was thus a typical mercantilist measure, since national power and security were the principal ends in view. The important acts of 1651 and 1660 were, however, chiefly expressions and a modification of earlier policies and theories. As early as 1381, English merchants had been instructed to employ English ships only.[133] The obligation to use English ships was sometimes

[131] Barbour, pp. 265–266.
[132] Andrews, IV, 29.
[133] E. Lipson, *An Economic History of England*, 3 vols. (1931), III, 116.

laid on the chartered trading companies.[134] The great Commonwealth statute of 1651, however, went much farther. Navigation monopolies were established in the inbound carrying trades to Great Britain from America, Asia, and Africa. In the inbound carrying trades from Europe, foreign ships could carry only the produce of their own countries, or produce which was usually exported therefrom. Hence Dutch craft were excluded from all import carrying trades except the direct one from Holland. The coastwise trade was also monopolized. Parliament modified and extended this system in 1660 and again in 1663. The inbound carrying trade to England, Ireland, and Wales from America, Asia, and Africa was continued as a preserve of the national shipping industry. English ships were also given a monopoly of all inbound and outbound foreign traffic and intercolonial business of the British plantations. The traffic between the colonies and England, Wales, and Ireland was also monopolized. To make the protection more effective it was provided that all European cargoes destined for the colonies were to move through English and Welsh ports, and that many of the chief colonial exports — the enumerated commodities — were to be shipped out only to such ports. English ships were defined as those which were built in England, Ireland, and the colonies and were commanded and manned to the extent of three fourths of the crew by Englishmen. Although this system was exceedingly complicated, there being many exceptions, evasions, and problems of definition, it is clear that in the main its effect was to shut foreign shipping out of many employments in which it had formerly been found, thereby enabling British tonnage to increase in quantity.

The evidence points to the conclusion that the British government achieved the results which it desired. A notable expansion in the British shipping industry clearly resulted, although at the expense of a considerable increase in costs of shipment on the protected routes, especially in the seventeenth century before the colonial shipyards became active. The requirement that the new fleet had to be built within the country or colonies meant that in England, at any rate, increasing costs were certain to be encountered because of the timber situation. The measure therefore provided a high degree of protection for the shipyards of England. As the eighteenth century wore on, however, the rise

[134] Andrews, IV, 20–21.

of the colonial shipbuilding industry, and the resulting increase in the supply of cheap, small-sized merchant ships in the colonial, West Indian, and British ship markets decreased the protective influence of the policy to some extent, and likewise relieved the shipowners of some of the disadvantages of high vessel prices. It is probable that the colonial yards could construct small ships as cheaply as the Dutch yards. The building of very big ships was, however, not undertaken in the colonies, with the result that British owners were forced to buy these vessels from domestic shipbuilders. Thus the policy achieved the aim of making the empire self-sufficient in shipbuilding.

In shipping the measures were, as a whole, highly protective. British and colonial shipping operated at higher cost than Dutch and Baltic shipping, and hence was little employed in those carrying trades in which, under the law, competition was to be encountered. The Dutch were, however, eliminated from the carrying trade of Britain in many cases. In that of the Baltic, for instance, their places were taken by the ships of Danzig and Lübeck, and other eastern nations, which could legally engage in the business and were sailed more cheaply. In the carrying trades to other ports of Europe, British ships shared the trade with vessels of the countries concerned. In the long-voyage monopolized carrying trades, however, an important preserve for English and colonial shipping activity was established. The rising volume of shipping activity in the colonial trade was particularly important. Since England was able to establish these monopolies on many of the important new world routes, it is not surprising that British shipping began to expand more rapidly than that of other European nations. The effect was, indeed, similar to the influence of the protected American coastwise carrying trades on the development of the American merchant marine in the nineteenth and twentieth centuries. The policy undoubtedly raised the costs of providing English shipping services, and to this extent hampered trade, but, despite evasions, it clearly stimulated the shipping industries of both the mother country and the colonies. It likewise limited the development of those of Holland and other countries whose ships operated at a competitive advantage. The expanded shipping industry thus secured was undoubtedly an important force strengthening the navy, providing

secure sea communications, and promoting the development of the British Empire. The policy may be said, therefore, to have achieved the objectives of the government.

Thus at the close of the colonial period the navigation policy was one of extreme autarchy. In many respects, it was a policy which weighed heavily on commerce and prevented a normal routing of tonnage. It was, however, a policy which was well adapted to the small-scale individualistic shipping enterprise of the time. Within the protection of the monopolies the normal effects of competition could be expected to arise. None of the complicated problems arose which were to occur when subsidies were given. Thus, although the system was costly and somewhat clumsy, it served the needs of the national state of that time.

It was this type of policy which the United States encountered after the Revolution. To the economic situation in the maritime industries following the breaking away of the American Colonies from the British Empire we must now turn our attention.

CHAPTER VI

THE RISE OF THE SHIPBUILDING INDUSTRY IN THE UNITED STATES, 1789–1830

I

THE AMERICAN REVOLUTION marks a milestone in maritime history, both because it caused the establishment of a new center of political power and of economic control in the New World and because it initiated a long period in which navigation was disturbed by war. Most significant was the fact that the high degree of unity and self-sufficiency in maritime affairs which had existed within the old British Empire was destroyed. Instead, there arose two maritime powers, located on opposite shores of the Atlantic Ocean, each of which was desirous of increasing its shipping activity and naval power. For the first time a sea power arose outside of western Europe.

The Revolution destroyed the very economical division of labor which had developed between the British North American colonies and the mother country in respect to the maritime industries. Within the British Empire a large part of the shipping enterprise had been supplied by London, Liverpool, Bristol, Glasgow, and other seaports of the United Kingdom, where capital was relatively cheap and plentiful and captains and seamen were numerous. A large proportion of the vessels, however, had been built in the rising shipyards of North America, as we have seen, and had the Empire continued to exist, probably nearly all of the British merchant and naval vessels would have been constructed in this favorable location. Thus a most economical combination of resources had been evolved. No other sea power was in a position to pursue so successfully and economically a policy of autarchy in respect to shipping and shipbuilding. This efficient system was shattered by the peace treaty of 1783, as a result of which both Great Britain and the United States strove to become self-sufficient — the British to develop their shipbuilding, and the Americans to increase their shipping. Each government thus developed

strong protective or otherwise fostering policies in order to support and expand its shipping and shipbuilding industries.

During the three-quarters of a century following the establishment of the American government, economic conditions were remarkably favorable for the rise of strong shipping and shipbuilding industries in the United States. The United States government, furthermore, successfully capitalized on these advantages, as well as on the blunders in economic policy of its rivals. The reciprocity policy of this period, in particular, was well calculated to promote expansion. Hence at the mid-century mark the merchant marine of the United States, with 3,535,454 gross tons on the register,[1] ranked only slightly behind that of the United Kingdom, excluding the colonies, which then totaled 3,565,133 net tons, or about 3,850,000 gross tons,[2] although Britain had much labor and capital and her shipping was supported by the huge commerce of the British Isles. American owners and shipbuilders may be said to have had both a competitive and a comparative advantage during this period. They had a competitive advantage because they could generally carry cargoes more cheaply than the shipowners of any of the nations of western Europe, with the possible exception of those of Hamburg, Bremen, Lübeck, and Danzig. They had a comparative advantage because the maritime industries yielded sufficient returns to make them desirable investments and employments in a country where free land and industrial growth had raised wage and profit levels above the European standards. Therefore the rising American shipping and shipbuilding industries pressed with considerable force against the protective barriers which were raised in Europe against them.

It is important to recognize that the comparative and competitive advantages of the shipowners were the combined result of the economic conditions in the several stages of production ranging from the securing of the shipbuilding material to the operation of the ships. Considering these stages individually, it is evident that the United States possessed an important advantage only in that of supplying the principal shipbuilding materials, namely, oak timber, oak and hard pine planking, and pine masts. The advantage in this stage was so large, however, that a marked

[1] *Annual Report of the U.S. Commissioner of Navigation*, 1901, p. 561. (Hereafter cited as A.R.C.N.)

[2] A.R.C.N., 1901, pp. 468–471.

advantage in the price of ships was secured, despite the high wage levels prevailing in the American shipyards. Furthermore, since the sale of new American ships to the principal maritime nations of Europe was generally prohibited by the governments of these countries, although not by that of the United States, this advantage in the costs of ship construction finally culminated in a favorable ship-operating differential. Actually, despite the efficient organization of American shipping enterprises and the man-driving of the shipmasters, the cost of operating American vessels was generally considerably above that of the nations of western Europe throughout the period from 1789 to 1914, if the differences in the prices of new ships are not taken into account. Since the advantage in ship operation was based on that in shipbuilding, the depletion of the timber supply was certain to cause a serious contraction in the American shipping industry sooner or later. Until the middle of the nineteenth century, however, the American owners were able to maintain a substantial advantage, and to dominate a large part of the world's carrying trade.

The development of the American merchant marine was controlled, first, by changes in the basic economic conditions under which it operated, and, second, by the success of the federal government's navigation policy in protecting the industry against foreign competition and discriminations and in removing the restrictions established by foreign governments on the operation of American ships in various carrying trades. More specifically, the amount of tonnage operated by American owners at any time depended on a complex group of circumstances. First, the volume of cargo movement on the American foreign-trade routes, of which those to Europe and the West Indies were most important, was of primary significance. During the Napoleonic Wars the volume of this traffic fluctuated severely, but the underlying expansion was, nevertheless, sufficient to generate a very substantial boom in the American maritime industries. The second circumstance was the amount of the participation of American-flag vessels in these foreign carrying trades. This was governed by the complex conditions which determined the competitive advantage of American shipping, and by the complicated navigation policies which were put into force by the rival maritime nations of Europe. In this connection, it is to be noted that by 1830 the American government had succeeded in substantially removing many of the foreign

restrictions affecting American shipping. The third circumstance was the volume of the cargo movement in the protected coastwise trades, which, although secondary in importance to that in the foreign trade during the early years of the nineteenth century, was of considerable significance. The amount of this traffic was affected, in turn, by the growth of the national economy, the rise of industry, and the relocalization of agriculture. The fourth circumstance was the degree to which American tonnage was able to find employment in general tramping and trading operations between foreign ports, and in the international entrepôt business of American ports. These were generally precarious employments, however, because of the wars, alterations in the volume and direction of world trade, and changes in trade regulations. It may be seen, therefore, that many forces besides the competitive advantage of the shipping industry determined its development.

The competitive advantage of the American shipping industry appears to have been greatest during the early years of the Republic. By 1830 increasing costs in shipbuilding began to be felt. From about 1800 to 1830, however, the favorable differential in operating costs was very great. This is reflected in the statistics, although the American advantage appears in an exaggerated manner because of the existence of protective navigation laws. Nevertheless, it is noteworthy that between 1821, when reliable statistics first appeared, and 1830, the proportion of American-flag tonnage among that entered and cleared in the foreign carrying trades ranged between 85 and 91 per cent.[3] After 1830 the percentages slowly declined. This early period was one of extraordinarily vigorous maritime enterprise, in which the operation of small-sized private trading ships on speculative voyages to Europe, the West Indies, and the Orient was the characteristic type of activity. The ships employed were small sailing vessels, which rarely exceeded 400 gross tons in size and one hundred feet in length. These vessels were rigged as ships, brigs, schooners, and sloops as their sizes and the nature of the trades in which they were employed dictated. Such vessels were very inexpensive to build and navigate, and were turned out by the shipbuilders in large numbers. They were owned by the small firms, generally proprietorships or small partnerships, which were

[3] U.S. Department of Commerce, *Merchant Marine Statistics*, 1937, p. 74. (Hereafter cited as Mer. M. Stat.)

typical of the American economic life of this period, and were employed in the many and diverse operations which the individualistic capitalism of the early American period devised. Many of these ships were employed in the general trading operations of American merchants. Others were used to carry their owners' fish, lumber, or other produce to foreign or domestic markets. Others were tramps which engaged in the foreign and domestic carrying trades. Some were employed on the famous long-distance trading voyages of this period in which many captains and owners made fortunes if their speculations in respect to the demand for and prices of goods turned out well.[4] American-flag ships were thus in great demand for nearly all purposes.

Active pioneering enterprise, keen competition, and a close alliance between the trading and shipping interests characterized this period. It was the age of small-scale firms in both shipbuilding and ship operation, and small shipments predominated. The chief carrying trades in which vessels were employed were the comparatively short-voyage ones of the North Atlantic. A large part of the fleet was employed in the trades from New England, New York, and Philadelphia to the West Indies and southern continental ports. Havana, Haiti, Porto Rico, Martinique, St. Eustatia, Curaçao, and other West Indian sugar ports were familiar names in the shipping lists. Other ships were used in the transatlantic carrying trades to England, France, the low countries, the Levant, and the Baltic. Still other American vessels were used in the Pacific and Indian Ocean trades, but the pattern of American shipping activity was scarcely world-wide as yet, although it was soon to become so. Within the principal fields of operation for American vessels, however, there was ample scope for the employment of tonnage; and the coastal waters of the United States and the principal North Atlantic routes of American shipping were consequently whitened with the sails of American private traders, industrial carriers, and tramps.

Thus the nature of the shipping industry was conditioned by the scope, direction, and organization of commerce. Later the development of a greater world-wide division of labor was to cause the rise of important bulk-cargo carrying trades, and hence larger and more economical sailing freighters were to be in demand. This same development was to cause a separation between the ship-

[4] For an account see R. D. Paine, *The Ships and Sailors of Old Salem*, 1924 ed.

ping and mercantile functions. More involved technical and economic problems were to come with the construction of larger vessels and the rise of larger-scale enterprise. But for the time being, small-scale trading operations and freighting activity dominated the activity of the American shipping industry. In these operations keen competition, individualism, and abundant material resources gave American shipping a remarkable vigor. At the bottom of this economic activity was the ubiquitous and active shipbuilding industry of the early years of the Republic, which we shall now examine.

2

The advantage of the American shipping industry during this early period was evidently based on conditions which restricted the sale of American vessels primarily to the domestic market. The Revolutionary War had seriously interrupted the important business of building ships for British owners, although even during this period a few craft were marketed in Britain. In 1786, however, the British government extended the provisions of the navigation laws dealing with the registration of vessels to the free American colonies, and consequently the important British market was closed to the American shipbuilding industry.[5] Henceforth, until the repeal of these laws in 1849, the British shipping industry was forced to confine its purchases of new ships to vessels built in Great Britain or in the British possessions, in none of which was shipbuilding well developed, although Canada and India had potentialities. British shipowners had, therefore, to pay considerably higher prices, or to accept lower quality, or both. Furthermore, the Baltic timber, of which British-built vessels were constructed, for the most part was subjected to a substantial and burdensome duty from 1793 until 1860, mainly in order to encourage the use of Canadian timber.[6] Thus the British government protected a shipbuilding industry which was operating under conditions of high and increasing cost, and was further handicapped by duties levied on its principal materials. Under these circumstances, a system of extensive navigation monopolies was necessary to protect British shipowners from foreign com-

[5] 26 Geo. III, c. 60.

[6] Clapham, *An Economic History of Modern Britain*, I, 237–238, 478–479, 496–500; II, 219–220.

petition. Consequently the British shipping industry retreated to the shelter of these protected trades, leaving the unprotected business largely to American and Baltic shipping.

The other western European nations for the most part followed the same policy. The revolutionary government of France, which was influenced by the success of the old British Restoration statute but failed to analyze the basis of its success, closed the markets of France to American shipbuilders in 1793, and reserved the right of registry exclusively to vessels built in France or her colonies and to prizes of war.[7] This law, which remained in effect for half a century, was one of the chief hindrances to French maritime development. Protection was also accorded the shipbuilders in the important maritime countries of Holland and Spain throughout much of this period. This was a serious matter, for in all of the ports of western Europe conditions of increasing cost appear to have prevailed because of the growing timber famine. Had protection not been employed, large-scale purchases of ships in the United States would certainly have followed. This is shown by the fact that even Holland, which at times had achieved remarkable efficiency in the mass production of ships, readily bought American- and Baltic-built vessels during the few years after the wars when her markets were open. The protectionism of European navigation policies thus played into the hands of American owners, who were able to secure almost exclusive access to the output of the American shipbuilding industry.

The resulting situation was extremely favorable to the growth of the American shipping industry, although it was perhaps less satisfactory to the shipbuilders, at least at first. The closing of the British market at first seriously depressed the shipbuilding industry, as might be expected. Prices of ships fell to very low levels, and bankruptcies were common. American owners soon found, however, that, as long as their European rivals were limited in their ship purchases, the acquisition of ships for the foreign carrying trade was very profitable. Shipbuilding consequently soon revived, but the sales were almost exclusively to American firms. In fact, it was not until after the repeal of the British navigation laws in 1849, and the revision of Lloyd's construction

[7] Lucien Lefol, *La Protection de la construction navale en France et à l'étranger* (1929), p. 12.

rules in 1854, which actions again allowed American yards to sell their products on an extensive scale overseas, that the competitive position of American-flag vessels on the primary American deep-sea trade routes was seriously threatened. Thus, for over half a century, American shipowners secured almost exclusive possession of the benefits of the low costs of shipbuilding in the United States, and as their resources increased they were able to place large and increasing orders with the shipyards.

The economic conditions along the entire coast from Maine to the Virginia Capes continued to be extremely favorable for the shipbuilding industry during the period from 1783 to 1830, and indeed improved as the industry became better organized. This was particularly true in the important matter of the timber supply. In general, abundant stores of large oak and pine timber were still readily available close at hand at nearly all of the maritime centers. The supply conditions were further improved at Boston and New York by the construction of canals, which brought additional stands within the range of economical access. In many other regions, particularly in Maine, large forests remained standing close to tidewater ready to be cut. This, then, was one of those periods of prosperity based primarily on the utilization of new resources which have characterized the economic development of the free, individualistic, American economy. Before the Revolution the shipbuilding resources of the country had, in fact, scarcely been tapped. After 1830, on the other hand, increasing difficulties and rising costs were encountered in securing timber. Finally, following the Civil War the life of the shipbuilding industry was to be cut by the scissors of sharply rising timber and labor costs at home, and falling iron prices abroad. During the early years of the Republic, however, ship timber remained, for practical purposes, readily available from Maine to Georgia, and with the aid of this resource the builders proceeded to erect an industry of international importance.

Certain disquieting signs appeared, at an early date, however, in the form of local timber shortages in some of the older centers. In some of these the industry died out comparatively soon as longer hauls became necessary. For instance, at Hanover, Pembroke, and Scituate on the North River, the headwaters of which were very limited in extent, a scarcity appeared at about the time of the Revolution and became worse during the first three decades

of the nineteenth century, with the result that many shipbuilders migrated to other ports. Builders are said to have advised their sons and apprentices to move elsewhere. Some established the industry at Medford on the Mystic at the beginning of the nineteenth century, and others moved to Bath and other eastern ports. Among the leading sons of the North River industry who later achieved fame elsewhere may be mentioned Calvin Turner and Galen James of Medford, Samuel Hall and E. and H. O. Briggs of Boston, and Noah Brooks and E. Stetson of Camden.[8] Indeed, by 1845, when the industry began its rise to great heights in many centers, shipbuilding on the North River was seriously decadent.[9] Timber supplies were also short in the vicinity of the important shipbuilding towns of Plymouth, Duxbury, and Kingston by 1815, and by 1834 the shipyards there were seriously crippled.[10] In the Salem area, where shipbuilding had long been carried on, it was necessary for builders to go some distance into the interior to get timber by 1800, and soon afterward the shipbuilding industry there began to decay. A serious shortage also arose in parts of the Narragansett Bay region about 1815.[11] Some difficulties also appear to have developed at Philadelphia, where shipbuilding had been actively conducted for a century.[12] Although these shortages were local, and therefore were not serious from the national standpoint, they were, nevertheless, a warning that in the future, if the situation became general, the American shipbuilding industry, and the American shipping industry as well, which was dependent on it, would encounter rising costs.

3

During the period from 1783 to 1830 the shipbuilding industry was extended geographically to almost the entire eastern seaboard as a consequence of the increase in the demand for vessels, the extension of settlement, and the appearance of timber difficulties

[8] J. S. Barry, *History of the Town of Hanover, Mass.* (1853), p. 159.

[9] Briggs, Appendix.

[10] James Thatcher, *History of Plymouth* (1835), p. 334. He writes: "Shipbuilding was formerly carried on to a considerable extent in this town; many excellent vessels have been sent from our shipyards, but the business is now diminished on account of the scarcity of timber."

[11] *Report of Surveys of Naval Officers* (1818), Senate Doc. no. 104, 15 Cong., 1 Sess., p. 13.

[12] Scharf and Westcott, III, 2336–2337.

in some of the older locations. The leading centers during the colonial period had been Salem, Newburyport, Portsmouth, Boston, Plymouth, Hanover, Narragansett Bay, and the Delaware. During the early national period, however, many important activities sprang up in favorable locations along the Maine coast and rivers, the Connecticut shore, the Hudson, and Chesapeake Bay.

The shipbuilding industry assumed the form of a highly decentralized, small-scale industry which it was to maintain until after the Civil War. Since the size of vessels was small, it was possible for builders to seek the advantages which decentralization and the use of upstream and rural locations could give in respect to timber and labor supplies. Many of the numerous waterways and bays along the coast became the sites of nests of shipyards. Builders in many cases sought the heads of navigation of the numerous streams in order to secure better access to inland stands of timber and the services of sawmills. Other yards were set up close to farm or town, and the timber was hauled to them by ox team, raft, or sailing barge. Vessels were built on sandy beaches, broad grassy meadows, marshy creeks, and forest land. A few were even built inland. Among these was the small West India schooner *Waterborough*, which was built by two men, Josiah and William Swett, on the side of Mount Ossipee in the White Mountains during the years 1818–1820, and was hauled during the winter time to the sea, twenty-five miles distant, at Kennebunk, Maine; the three-day haul required fifty yoke of oxen.[13] Shipbuilding thus almost literally became a prominent feature of the entire seaboard economy.

Particularly notable was the development of the shipbuilding industry in Maine, which was later to be the primary center of construction. The excellent timber and many coves and streams there began to attract builders in the fourth quarter of the eighteenth century. Shipping and shipbuilding went hand in hand at first, for many of the vessels were employed to export lumber and fish and to import rum, sugar, and molasses. After the turn of the century, however, Maine builders began to address themselves to the more important European carrying trades. Typical of the Maine development was the rise of Kennebunkport, which in 1750 was a small hamlet located on an exceedingly small river.

[13] *Portland Press Herald*, Feb. 15, 1935.

The first vessel, a schooner, was not built here until 1755,[14] but by 1800 the town had become a thriving mercantile center containing nine master builders, who in that year turned out twelve vessels, totaling 1683 gross tons, including three full-rigged ships.[15] Shipbuilding was also extensively carried on in Casco Bay at Portland, where there were some five establishments as early as 1756,[16] at Yarmouth,[17] at Freeport, and at Brunswick.[18] The great era of shipbuilding began on the Kennebec soon after 1783, when there were some ten builders in Bath alone, and waterfront property was rising in value.[19] Others established themselves upstream at such places as Dresden,[20] Pownalboro, Gardiner, and Bowdoinham. By 1830 it is probable that there were as many as fifty builders between Fort Popham and Waterville, the place farthest up stream where construction is recorded.

Shipyards were established further to the eastward somewhat later. On the Sheepscot River shipyards were established at Boothbay,[21] Wiscasset, and Alna. They also appeared before 1775 on the Damariscotta River, but the prosperity of the towns there dates from about 1800.[22] On the Medomak River the first yard was established by one Merritt in 1810.[23] Shipbuilding on the St. George River at Warren and Thomaston did not begin until after 1770, and did not become significant until about 1803, when the construction of full-rigged ships for Boston owners was begun.[24] At Camden on Penobscot Bay several yards were set up in 1813, and one builder, Joseph Stetson, was to build over seventy vessels.[25] Builders also appeared more to the eastward at Ellsworth, Mount Desert, Machias, Eastport, Pembroke, and Robbinston. Thus during the revolutionary and early national

[14] E. E. Bourne, *History of Wells and Kennebunk* (1875), pp. 575–576.

[15] Bryant.

[16] Rowe, pp. 53–54.

[17] Rowe, pp. 87–88.

[18] G. A. and H. W. Wheeler, *History of Brunswick, Topsham, and Harpswell, Maine* (1878), pp. 330–331.

[19] Lermont, p. 7; P. McC. Reed, p. 77.

[20] C. E. Allen, *History of Dresden, Maine* (1931), pp. 746–747.

[21] F. B. Greene, *History of Boothbay, Southport, and Boothbay Harbor, Maine* (1906), p. 334.

[22] Cushman, pp. 325–331.

[23] Samuel Miller, *History of Waldoboro, Maine* (1910), p. 193.

[24] Eaton, *Annals of Warren*, 2nd ed., 1877, p. 673. The first large vessel was the ship *Fredonia*, 206 tons.

[25] Locke, pp. 223–234.

periods the foundations of shipbuilding were being laid in Maine ports as far east as Passamaquoddy Bay. Although at first the output consisted mainly of small schooners and brigs, by 1825 the state had become a center for the construction of larger craft for the more significant branches of the foreign trade. In that year there were built and documented in the state 8 ships, 101 brigs, 135 schooners, and 4 sloops with a total gross tonnage of 34,558.[26] Maine yards were thus building up their business, but they still were of minor significance.

Another important shipbuilding center to develop was New York, which before the Revolution had achieved little prominence as a maritime center, although several English builders had established themselves there.[27] New York was ideally situated, however, to be a shipbuilding center, for the Hudson, Mohawk, and Raritan rivers enabled rich timber supplies to be tapped, while the growing commerce of New York made it an excellent depot for southern live oak and hard pine and an important center of repair work. Progress was slow, however, as is shown by the fact that in the year 1788, for instance, there was built only one full-rigged ship, an Indiaman of 706 tons.[28] Eleven years later the construction of the Indiaman *Manhattan*, 600 tons, in Samuel Ackerley's yard, is said to have drained the port of its ship carpenters.[29] During the early nineteenth century, however, a number of very competent builders established yards and began the careful training of apprentices, with the result that the port soon became a center for the construction of vessels, especially those of great size and high class, such as the North Atlantic packet ships. One of the most noted builders was Henry Eckford, who arrived in New York from Scotland by way of Quebec in 1796, and achieved fame as a designer and builder of strong, durable, fast-sailing vessels.[30] At about the same time Christian Bergh, a loyalist exile, returned and established an-

[26] U. S. Treasury Dept., *Report on Commerce, Navigation and Tonnage, 1825.* (These annual reports are cited as R.C.N.T.)

[27] "Britain's Oldest Shipping Company," *Sea Breezes, the Pacific Steam Navigation Company Magazine*, XI, 73. One of these was Daniel Brocklebank, the founder of the well-known British shipping house of that name, who built five ships at New York before returning to England with the British forces.

[28] T. E. V. Smith, *The City of New York in the Year of Washington's Inauguration, 1789* (1889), pp. 104–105.

[29] Hall Report, pp. 115–116.

[30] Albion, *The Rise of New York Port, 1815–1860* (1939), pp. 288–291.

other yard. A third famous yard, that of Adam and Noah Brown, was set up about 1807. These and other firms became the nucleus of an extensive group of yards clustered along the East River waterfront near Corlears Hook. So greatly did construction increase that in 1826, for instance, there were built in New York twenty-three ships, three brigs, forty-nine schooners, sixty-eight sloops, twelve steamers, fifteen tugs, and nineteen canal boats, totaling 29,137 tons [31] — a truly remarkable record which placed New York in first place as a shipbuilding district. By 1830 the industry in this port consisted of fourteen yards and about 400 mechanics,[32] and the master carpenters had obtained a foremost place among the builders of high-class vessels.

The shipbuilding industry also arose in many other favorable centers, and activity was intensified in many older ports. The Merrimack River was said to have been by 1800 almost a continuous line of shipyards from Plum Island to Haverhill.[33] On the short, twisting North River there were some twenty-five yards occupying almost every available site from Hanover to the sea.[34] In the Boston area, which included Medford, Charlestown, Milton, Quincy, Weymouth, Hingham, and Cohasset, there was active construction in a score of yards after the turn of the century. In 1815, a good year, twelve ships, twelve brigs, nine schooners, and two sloops were built or completed in this area.[35] Ten years later three ships and seven brigs were built, but this was a poor year.[36] The builders here possessed a high reputation, the leading firms being those of John Wade, Samuel Hartt, Thatcher Magoun, Sprague & James, Calvin Turner, Noah Brooks, Josiah Barker, and Lot Wheelwright, each of which normally turned out two or three substantial vessels annually. There were in Boston during the years 1815–1817 some twenty-one master carpenters, of which about seven may be listed as major builders able to complete one or more full-rigged ships annually, and about twelve as merely builders of small vessels.[37] Shipbuilding also increased along the Connecticut shore, particularly on the Connecticut River at Had-

[31] J. H. Morrison, *New York Shipyards*, p. 54.
[32] J. H. Morrison, *New York Shipyards*, p. 57.
[33] Currier, pp. 21–24.
[34] Briggs, *passim*.
[35] Compiled from the Boston Registers and Enrollments, 1815.
[36] Boston Registers and Enrollments, 1825.
[37] The following interesting tabulation was made from the register and enroll-

dam, Essex, and Middletown, where abundant stocks of white oak and chestnut were available.[38] Many of the vessels built in southern New England were stout long-lived whalers destined for the growing whaling fleets of Nantucket, New Bedford, New London, and other ports, which fleets were beginning to penetrate distant seas.

Meantime, further south, Philadelphia, which had been one of the leading centers of construction for superior ships, was declining, and by 1815 was of only secondary importance, although a big ship of 1800 tons, probably a warship for Colombia, is said to have been built here in 1824 by Tees and Van Hoak.[39] Philadelphia builders had long been noted as builders of war vessels. Most of the work for the American Navy after 1815 was done, however, in the navy yards. In Baltimore, in contrast, building increased, especially after 1790. Two famous frigates were built here at the turn of the century, the *Constellation* by David Stodder, and the *Chesapeake* by De Rochebrun — a sure sign of the technical competence of the builders.[40] The chief products, however, were the rakish, fast-sailing, Baltimore clipper brigs and schooners. There was also some building in the South, in Norfolk and Charleston, but this was unimportant in quantity.

It is thus evident that by 1830 the industry was well organized and had adapted itself to the timber resources to a substantial degree. Henceforth it was to continue to migrate in response to differences in wage rates and in the relative rates of exhaustion of timber supplies in various regions. During this early period, however, increasing cost conditions had not become serious and the industry as a whole was able to build vessels at very low cost. Furthermore, the technical abilities of the masters and men, although not yet fully developed, were sufficient to produce strong, seaworthy, and efficient cargo carriers, which were the chief type

ment books of the Boston Customs House, 1815–1817, and indicates the number of master carpenters in each category:

Year	*Total*	*Builders of ships*	*Builders of ships and brigs*	*Builders of small craft only*
1815	21	7	11	10
1816	21	6	9	12
1817	21	3	7	14

[38] Hall Report, pp. 113–114.
[39] Scharf and Westcott, I, 617.
[40] Bibbins, in C. C. Hall, I, 77.

of vessel then required in the shipping operations of the new nation.

4

The demand for ships was dependent to a large extent, as has been indicated, on the general development of American foreign and coastwise commerce, particularly the former. The course of this commerce was violently affected by war, changes in commercial policy, and the rapid economic development of the country, and shipbuilding consequently rose and fell in accordance with the severe cycles of prosperity and depression in commerce caused by these factors. Nevertheless, the maritime industries were, on the whole, highly prosperous during the period from the close of the Revolutionary War to 1830.

The period of almost constant warfare which began in 1793 and lasted until 1815 caused an enormous expansion in American foreign commerce, shipping, and shipbuilding. The recurring crises, however, frequently ruined shipowners and builders, but the two maritime industries exhibited remarkable recuperative powers on each occasion. Many opportunities for large profits existed in the heavy eastward carrying trade in foodstuffs resulting from the wars, and this trade, in turn, provided the foreign exchange with which Americans purchased large cargoes of European products and manufactures for importation. Owners also found opportunities for profit in the long-voyage trades, which had formerly been served mainly by British ships, but had been opened with the achievement of independence. The thriving entrepôt business of some of the American ports and the carrying trades between foreign countries also provided profitable employments for tonnage. Many merchants who had formerly worked in conjunction with British firms and had employed British vessels now found it desirable to secure tonnage of their own. There is every evidence, therefore, that the American shipping industry, which was basically in a strong economic position, was able to expand to fill a void caused by the expansion of trade during the wars, the rearrangement of trade routes resulting from the establishment of independence, and the rising costs of British shipping enterprise caused by the high costs of shipbuilding in the United Kingdom.

The financial groundwork for the later expansion of the ship-

ping industry was laid at this time. The costs of ships and operations were still low while freight rates and commodity prices remained high. Excellent opportunities for large speculative profits on cargoes owned by shipowners also existed. Consequently there was a period of large profits, and a rapid increase in the capital resources of the shipping industry, which even war and illegal seizure did not check. Successful owners acquired large fortunes and increased their fleets with rapidity. The accumulations of capital and experience thus secured soon became available for the building and operating of larger fleets of bigger and better vessels. The profits of the war thus did much to lift the maritime industries out of the provincial status.

The rise of the shipbuilding industry generated by this commercial activity occurred in a series of booms. After a period of serious disorganization during the Revolution, production began to pick up in 1789 following the outbreak of trouble in France. War between France and England broke out in 1793, and shipbuilding soon became very active because of the appearance of a strong demand for vessels for the foreign trade.[41] Construction was extremely active in 1795 and 1796 when the boom was at its height, and it is probable that the output was around 100,000 gross tons in each year. Prices of vessels were relatively high, and the number of yards multiplied, particularly in eastern New England. The quality of the construction notably improved as a result of an increase in number of large full-rigged ships built for the European and Oriental trades. There was a sharp collapse in business in the years 1797–1798, however, and as a result construction declined to 56,679 gross tons in 1797, the first year in which statistics are available.[42] Shipbuilding again became active in the years 1800–1801, 1804–1806, and 1809–1811 in accordance with the oscillations in foreign trade. In 1811 a peak output for the entire period from 1789 to 1815 of 146,691 gross tons was reached.

The years of the War of 1812 were particularly disastrous for the shipbuilders; for there was little demand for tonnage, excepting small privateers; navigation was disrupted; and owners were frequently unable to pay for vessels already building. Many

[41] For a study of business conditions during this period see W. B. Smith and A. H. Cole, *Fluctuations in American Business, 1790–1860* (1935), pp. 3–21.
[42] Mer. M. Stat., 1936, p. 42.

builders who had commenced vessels on speculation were unable to complete, sell, or deliver them, and consequently many firms failed.[43] British warships blockaded much of the coast and raided the ports. At Kennebunkport boats from H.M.S. *Bulwark* burned and destroyed several new vessels and captured much equipment.[44] Similar attacks were made at Saco and other ports, with the result that new vessels were taken by their builders as far upstream as possible, and the laying down of new craft ceased. Many vessels remained on the ways unfinished. As a result, construction reached a low of 29,751 gross tons in 1814, and only three full-rigged ships were built in each of the years 1813 and 1814.

As might be expected, fluctuations in output were exceedingly sharp. Shipbuilding, being a capital-goods industry, naturally tended to fluctuate more severely than business in general. In addition, fluctuations in demand were intensified by special conditions arising out of the wars and affecting navigation. Blockades, attacks by cruisers, privateers, and pirates, and the Embargo and Non-Intercourse Acts were among the measures causing wide variations in demand. These variations were of substantial magnitude. For instance, construction rose from 77,921 gross tons in 1799 to 124,755 gross tons in 1801, and then receded to 88,448 gross tons in 1803. Then it rose again, after the resumption of war, to 128,507 gross tons in 1805, and then collapsed to 31,755 gross tons in 1808, when the embargo seriously injured shipping. Output again revived after the resumption of commerce, reaching 146,691 gross tons in 1811, a particularly active year, but receded after the outbreak of war to 32,583 gross tons in 1813. There is no evidence, however, that these fluctuations created such serious economic problems in the shipbuilding industry as were later to appear. In general the period of production was so short (it rarely exceeded six months), that the lag between the initiation of construction and completion was not a serious cause of error by merchants and owners. The appearance of opportunities for profitable carrying or trading hence immediately was reflected in the laying down of ships all along the coast, most of which were soon delivered. Conversely, crises in commerce brought immediate checks. Both labor and master builders became accus-

[43] Briggs, pp. 109–110.
[44] Remich, p. 257.

tomed to this oscillation, and developed alternative interests to which they could turn.

An examination of the meager statistical information available suggests the conclusion that the shipbuilding industry's total output during the early American period was at a much greater rate than that of colonial times. In 1769 the tonnage built in British America, including Bermuda and the Bahamas, is given as 21,370 gross tons, of which 20,081 tons were built in the thirteen colonies.[45] The figures comparable to the later number for 1770 and 1771 were 20,920 and 24,492 tons respectively, and the average for the three years was 21,631 tons. The British Inspector-General of Customs, Thomas Irving, was of the opinion, however, that these figures should be increased by about 50 per cent because of slackness in making returns, which, when done, gives an average output of 32,447 gross tons. Although these years may not have been typical of the later colonial period as a whole, a comparison with the output of the boom years 1804–1806 and 1809–1811, when the tonnage built averaged 119,451 and 121,888 gross tons, respectively, bears out the statements of contemporaries that the shipbuilding industry underwent a great expansion during this disturbed period.

The expanding scope of American navigation and the growing technical competence of the shipbuilders were also reflected in an increase in the number of relatively heavy vessels built. During the colonial era much of the construction had consisted of small brigs, schooners, and sloops. The Commons return of 1792, covering colonial output in the years 1769–1771, divides output into two classes: first, topsail vessels, which class probably includes ships, brigs, snows, and topsail schooners; and second, schooners and sloops, which class probably covers the fore-and-aft-rigged craft.[46] The output of the former group averaged 121 in number for the years 1769–1771. The American returns are not strictly comparable, but some comparison may be made. Taking the ships and brigs only, and thus eliminating the important group of topsail schooners, which are not distinguished in the returns, we find that the numbers were 87, 218, and 304

[45] *An Account of the Number and Tonnage of Vessels Built in the Provinces, 1769, 1770, 1771*, Journal of the House of Commons, 1792, pp. 356–357.

[46] *An Account of the Number and Tonnage of Vessels Built in the Provinces, 1769, 1770, 1771*, pp. 356–357.

in 1798, 1799, and 1800 respectively, the first two of which were relatively poor years.[47] If the numerous topsail schooners which were built for the West Indian trade could be distinguished, the figure would probably be considerably larger. Many of these square-rigged craft were full-rigged ships, the figures for 1799 and 1800 being 87 and 128 respectively. The war boom thus evidently introduced many of the builders to the intricacies of the building of large, deep-sea vessels.

5

Conditions remained favorable for shipbuilding from 1815 to 1830, but with the exception of a sharp boom in the period 1815–1818 there was little advance in output. The foreign carrying trade expanded notably during this short-lived boom, and many large vessels were built for it. There was a severe recession, however, in 1819, and the resulting depression lasted until 1824, when another boom began. Meanwhile the emphasis in shipbuilding shifted to smaller craft designed for the growing coasting trade, which was steadily becoming a more important influence in maritime affairs. The whaling industry also was prospering and required tonnage. The costs of construction were still low, but competition became more severe when peace was reëstablished and the cost of timber fell in Europe. The first golden era in American maritime history had thus ended soon after the conclusion of peace.

The year 1815 witnessed a new record in shipbuilding activity, no less than 155,579 gross tons being built as merchants sought to take advantage of the revival of trade, builders completed vessels previously commenced, and owners rebuilt their fleets. Another stimulating factor was the temporary opening of the Dutch ship market, where heavy sales occurred. The suspension of the Dutch registry law was for a five-year period, beginning in 1815, and was due to the severe injury which Dutch shipping had suffered in the wars and to the high costs of ship construction there in the Netherlands.[48] There were consequently heavy sales of American ships at Amsterdam, the business being doubtless re-

[47] A.R.C.N., 1901, p. 581.

[48] *Report on the Commercial Regulations of Foreign Countries* (1819), Senate Doc., 16 Cong., 1 Sess.; reprinted in *American State Papers, Commerce and Navigation*, vol. II, no. 223, p. 354. (Hereafter cited as A.S.P., C.N.)

sponsible for the large sales of American vessels abroad, which reached a peak of 23,379 gross tons in 1816 and averaged 16,019 gross tons for the four years 1816–1819,[49] which was about one sixth of the new construction. In the year 1815, in fact, no less than 136 ships and barks, 224 brigs, 680 schooners, and 284 sloops and barges were built and documented — an unprecedented number. Many new vessels arrived at Boston and New York from eastern yards, on carpenter's certificates, to be sold, thus reflecting much speculative activity. Within a few years, however, the market was seriously oversupplied, vessel prices fell, and construction was checked. By 1820 output was down to 45,822 gross tons, and there were only twenty-two full-rigged vessels in the year's list.

In general, shipbuilding activity declined slightly considering the period 1815–1830 as a whole. Excluding steamboats, the average annual output, which had been 119,451 gross tons for the fiscal years 1804–1806, and 121,888 tons for the years 1809–1811, fell to 106,897 tons, 67,719 tons, and 97,242 tons for the five-year periods 1815–1819, 1820–1824, and 1825–1829 respectively.[50] Reflecting the decline in offshore navigation, the demand for full-rigged ships declined sharply, but on the other hand small brigs suitable for the West India and coastwise trades became popular, and large numbers were built. This shift in the character of construction had the effect of reducing the strain on the timber supply. Not until after 1830 were large freighters again to be in great demand. American shipbuilding activity thus recovered some of its colonial appearance. The change in the source of the demand is indicated by the fact that of the new tonnage built, 53,102 gross tons was placed under enrollment for the coastwise trade in 1825, compared with 61,492 gross tons placed under register for the foreign carrying trade; whereas the comparable figures for 1815 were 48,545 gross tons and 106,079 gross tons.[51] The output of enrolled vessels in 1825 exceeded that in 1815 slightly, whereas that of registered vessels was but 48 per cent of that of 1815.[52] During the entire period from 1815 to 1829 the output of sailing ships in American yards consisted of 896 full-rigged ships and barks, 1872 brigs, 6809 schooners, and 3431

[49] A.R.C.N., 1901, p. 585.
[50] A.R.C.N., 1901, p. 581.
[51] R.C.N.T., 1815, 1825.
[52] R.C.N.T., 1815, 1825.

sloops and documented barges.[53] On the whole, the size of vessels declined. Most of these vessels were for the accounts of the numerous merchants and captains who traded widely in foreign and domestic ports. Ship operations after the wars, therefore, were adapted to the new structure of American seaborne commerce. During the following decades, however, great changes were to occur in this structure.

6

During these early years ship construction was chiefly concentrated in the coastal region from Baltimore to eastern Maine. One of the notable facts was the failure of the shipbuilding industry to develop in the South, which was a rich storehouse of excellent ship timber to which northern builders themselves later turned. There had been several yards at Charleston and Beaufort during the colonial period, and it is said that twenty-four square-rigged vessels, besides small craft, were built in this region between 1740 and 1779.[54] Live oak is said to have first been employed in the *Live Oak*, a ship built at Charleston in 1750.[55] The scarcity of suitable ports, the profitability of tobacco and cotton growing, and the shortage of skilled labor were serious drawbacks, however. The industry had, in fact, never been fully developed in the colonial period. In the three years 1769–1771, there were built south of Cape Hatteras in the English colonies only an average of 1500 tons each year, or 4.2 per cent of the recorded construction.[56] During the years 1829–1830, in contrast, the average had risen to 2106 tons, but this was only 3.4 per cent of the total.[57] Florida's contribution in 1829 was a brig and a schooner, although the state had the best frame timber in the world within its borders. The contribution of the South to the American merchant fleet, therefore, was comparatively small.

The primary difficulty appears to have been a shortage of skilled labor, which became more serious as the cotton boom progressed. Early in the century Charleston had had some good

[53] A.R.C.N., 1901, p. 581.
[54] Bishop, 1, 85.
[55] Bishop, 1, 85.
[56] *An Account of the Number and Tonnage of Vessels Built in the Provinces, 1769, 1770, 1771*, Journal of the House of Commons, 1792, p. 356.
[57] R.C.N.T., 1829, 1830.

yards which had occasionally turned out some large vessels.[58] One of these was the United States sloop-of-war *John Adams*, which, however, decayed unusually rapidly because of improper construction.[59] In 1833 there were but eight master builders and some one hundred ship carpenters in the city, and of the latter scarcely a score were white men.[60] Each yard employed a score or so of negro ship carpenters. As a result few apprentices were trained and the shipbuilding arts decayed. Labor costs were apparently high in relation to northern yards, the rate of pay for ship carpenters at Charleston in 1833 being $2.00 per day for white men and $1.00 for negroes, as compared with rates of from $1.00 to $1.25 in northern ports. Joiners and smiths apparently received about $1.50. Probably the colored ship carpenters were not highly skilled, for the builders complained of a shortage of competent men, both white and colored. The prices of new ships were consequently high. One example is that of the copper-fastened ship *St. Andrew*, 320 tons, built about 1804, which cost $22,000, or $69 per ton [61] — from 20 to 50 per cent above New England levels. Thus, the shipbuilding industry was at a comparative disadvantage in the South throughout the sailing-ship era, despite the fact that the North drew heavily on southern timber supplies. Not until the Industrial Revolution reached the South a century later was ship construction to grow there.

In the region north of Cape Hatteras, the New England coast from Cape Cod northeastward to the Canadian line remained the primary shipbuilding center of the country, constructing some 45 per cent of the tonnage. Thus there was little change in the localization pattern compared with that of the late colonial period. To a large extent the rise of New York and Baltimore was offset by the extension of the industry into Maine. The Chesapeake area rose to second place in the years 1829–1830, however, whereas New York, New England west of Cape Cod, and the Chesapeake Bay area had been close rivals in the order named in

[58] *Report on the Advisability of Establishing a Navy Yard at Charleston, S. C.* (1836), Senate Doc. no. 360, 24 Cong., 1 Sess., pp. 23, 31.

[59] Historical Statement on Live Oak, pp. 196–197.

[60] *Report on the Establishment of a Navy Yard at Charleston, S. C.* (1834), House Rep. no. 199, 24 Cong., 1 Sess., p. 19.

[61] *Report on Establishing a Navy Yard at Charleston, S. C.* (1836), Senate doc. no. 360, 24 Cong., 1 Sess., p. 32.

the years 1769–1771. Figures showing this localization are given below. They cover short periods of time, and hence are not entirely satisfactory. Furthermore, it should be remembered that the contribution of New York and perhaps Baltimore may have been slightly overstated because of the practice of selling eastern-built vessels in these ports on speculation, the coastwise voyage being made in ballast on a carpenter's certificate, in which case they unfortunately appeared in the returns as if built in the port of sale. The colonial figures are also admittedly inaccurate and incomplete. Nevertheless it is believed that these returns indicate reasonably well the distribution of shipbuilding activity for the years named.

Percentage and Amount of Tonnage Built in Certain Shipbuilding Areas, 1769–1771, and 1829–1830 [62]

	1769–1771		*1829–1830*	
Region	*Tonnage*	*Per cent*	*Tonnage*	*Per cent*
E. New England	11,318	47.3	27,277	44.3
W. New England	3,386	14.2	3,872	6.4
New York	3,613	15.1	7,488	12.3
Delaware River	1,761	7.4	6,805	11.2
Chesapeake	2,863	11.9	13,720	22.4
South	1,008	4.2	2,106	3.4

In the construction of large, deep-sea vessels eastern New England yards were particularly predominant during this period, despite the rising fame of the New York packets. Much of the tonnage of New York and the other "western" ports consisted of small craft for the river and coastwise trades. Assuming that registered schooners, i.e., vessels which took registers for their first papers, were substantial seagoing craft, the following table, showing the great superiority of the eastern yards in the construction of heavy vessels, has been compiled.

In these years almost one half, or 48 per cent, of the vessels of this type were constructed east of Cape Cod, a figure which was

[62] Compiled from the accounts in the Journal of the House of Commons, 1792, p. 356, and in R.C.N.T., 1829, 1830. The figures for 1829 and 1830 for New York and Pennsylvania include construction on the Great Lakes and western rivers, but it is unlikely that the figures are seriously in error. The figures for tonnage for 1769–1771 are those given in the official return. They should be increased by about 50 per cent to give correct magnitudes.

exactly the same as that for the years 1769–1771.[63] Of the other areas, New York's percentage had advanced from 7 to 18, the Chesapeake's from 16 to 25, and the Delaware's from 16 to 18, whereas that of western New England had declined from 16 to 5.

Paradoxically, a few ocean-going craft were also built on the Ohio River, where there were splendid timber stands. Among these were the brig *St. Clair*, 110 tons, which was built at Marietta in 1801 and was sailed to Philadelphia,[64] and the ship *Orlando*, 207 tons, which was built in Gallia County in 1810, and was eventually sold at Gloucester.[65] This construction continued spasmodically as late as 1848, when we find that the bark *Matilda*, 410 tons, was constructed at St. Louis.[66] She eventually passed

AVERAGE NUMBER OF SHIPS, BRIGS, AND REGISTERED SCHOONERS BUILT IN CERTAIN AREAS, 1829–1830[67]

Region	*Ships and Barks*	*Brigs*	*Registered Schooners*
E. New England	23	31	13
W. New England	2	5	2
New York	5	7	6
Delaware River	3	8	2
Chesapeake	2	11	13
South	0	1	2

into the ownership of the Boston firm of A. Cunningham. Builders engaged in construction in the West pursued a regular routine, building in the winter and navigating their products down the Ohio and thence to eastern ports, either directly or by way of the West Indies, where they were sold, the builders returning overland with the goods purchased with the money. Shipyards on the western rivers never played an important role in American maritime development.

Several reasons may be adduced for this concentration of ship-

[63] *An Account of the Number and Tonnage of Vessels Built in the Provinces, 1769, 1770, 1771*, Journal of the House of Commons, 1792, p. 356. The category "Topsail vessels" is assumed to be comparable to that including ships, barks, brigs, and registered schooners, as given above.

[64] E. C. Kirkland, *History of American Economic Life* (1932), p. 260.

[65] Boston Registers, 1815, no. 194. Her dimensions are given as 102 × 22 × 10 feet. She was rebuilt in 1813.

[66] French, pp. 34–36.

[67] Compiled from R.C.N.T., 1829, 1830.

building in the eastern New England area. The deeply indented coastline permitted an extensive dispersion of the industry in this area with consequent advantages in access to timber and rural labor supplies. Labor was somewhat cheaper owing to the greater distance from the new lands of the West. It was also more skilled because of the nature of the early immigration. The existence of numerous well-trained and resourceful master carpenters in this area also counted for much. Furthermore, many owners preferred to order vessels from builders who were known to them, and whose yards they could visit, for there were many operations in which a builder could "cut corners" if he so desired. Since eastern New England was a center of the deep-sea trade these personal relations gave builders there an advantage for a time. The main factor, however, was the ability of the builders profitably to sell good ships at lower prices than could usually be secured elsewhere. New England yards even exported vessels, especially small freighters, on a small scale to New York, Baltimore, Philadelphia, and other centers. Many of the vessels so exported were built on speculation and were sold in the large city ship markets either immediately or after several voyages, if opportunity offered. Others were built on order. The eastern New England yards thus had a considerable competitive advantage.

During the early years of the nation the shipbuilding industry along the entire seaboard reached a high degree of maturity. Based on incomparable supplies of timber, and stimulated by the advantages of American shipping in the foreign carrying trades and by the rise of the coastwise trade, it was able to achieve a much higher level of activity than had formerly prevailed. Attention was concentrated on the building of small, stout, durable vessels suited for the needs of American owners and merchants. Shipyards were set up at suitable places on almost every tidal waterway from Eastport to Cape Hatteras, but the real center of operations was in eastern New England, where both timber and labor conditions were favorable. The industry was conducted by a great number of small master builders, probably in excess of five hundred, none of which had plants of really large size. Some of these, perhaps as many as a hundred, were engaged in the building of heavy vessels, such as Indiamen and packets, and the rest divided their attention among the innumerable smaller vessels which were needed. The business was sensitive to business

conditions, and quickly reacted to changes in demand. The industry was, on the whole, in a healthy condition, although the state of the timber supply gave some cause for anxiety. This favorable position of the shipbuilders was, under the navigation systems then in force, the chief factor enabling the American merchant marine to reach its position of world-wide prominence.

To a comparison of cost levels and naval architecture in the United States and abroad we now turn.

CHAPTER VII

SHIP TIMBER AND SHIPS: SOME ASPECTS OF THE AMERICAN SHIPBUILDING INDUSTRY 1789–1830

I

IN CONTRAST to the favorable conditions under which the industry operated in the United States, shipbuilding in the maritime nations of western Europe was carried on under conditions of much higher and constantly rising real cost during the latter part of the seventeenth century and the first part of the eighteenth century. The timber situation was, indeed, approaching the crisis stage as the wooden age in this area neared its end. In the United Kingdom, France, Holland, Spain, Portugal, and western Germany the accessible stands of suitable large ship timber were seriously depleted by the turn of the eighteenth century. Local supplies of oak frame timber and masts were consequently difficult and expensive to secure, and hence the shipyards were being forced to rely on costly overseas supplies. Many yards were using second- and third-rate timbers and undersized trees in an effort to preserve their competitive positions, but this policy often resulted in inferior vessels which were weak and subject to rapid decay. Later the American shipbuilders were to be forced into the same practice. Consequently European builders were encountering rising costs so far as timber supplies were concerned. A temporary position of stability in the business was reached only when the prices of ships rose high enough to permit of the unlimited importation of timber from the vast overseas forests which were for the time being inexhaustible. This position of stability was scarcely achieved, however, before the introduction of iron hulls put an end to the building of wooden ships, and hence throughout the age of wooden ships in Europe the general trend in cost was upward.

The condition of rising cost was encountered to a severe degree in the British Isles, where difficulties had been experienced as early as the mid-eighteenth century because of the inadequacy

of the British timber conservation policies.[1] The strain of the naval demands caused by the Napoleonic Wars and by the general expansion of the shipping industry still further reduced these meager stocks between 1775 and 1830. The five main Royal Forests were seriously depleted and private supplies were reduced to the vanishing point when Trafalgar was fought. In 1783 the Royal Forests had contained but a small fraction of the oak reported in them in 1608.[2] Much of the timber then available was in relatively inaccessible areas, some of which were thirty miles or more from the waterways, and hence rising costs were encountered in hauling out this remaining stock. Some supplies of small-sized oak, larch, and fir were available, but when used these woods produced inferior vessels. Great difficulty was found in meeting the needs of the naval dockyards, and hence merchant shipbuilders often could not secure the English-grown keels, stems, and sternposts which they needed.[3] By 1863 they were to complain that the Navy "had got every load of timber which any amount of money could have gotten." Serious doubts were expressed by the builders regarding their ability to continue.[4] As early as 1815 Britain had been bare of anything which could be called a forest.[5] British maritime supremacy and communications were seriously threatened by this situation, which made the construction of large warships both difficult and expensive and made the protection and promotion of the shipping industry burdensome. It is thus evident that the American Revolution was a severe blow to the maritime power of Great Britain, for it caused her traditional policy of high protection to become dangerously burdensome. Furthermore, the policy of protecting agriculture made the raising of grain and sheep more profitable than the growing of oaks, at least from the all-important standpoint of immediate return, although stumpage prices rose fourfold between 1794 and 1814.[6] It may be concluded that under laissez-

[1] Albion, *Forests and Sea Power*, p. 134.
[2] Albion, *Forests and Sea Power*, p. 136.
[3] Ditchburn, shipbuilder, in discussion, *Trans. I.N.A.*, IV (1863), 148.
[4] *Report of the* [British] *Select Committee on Manufactures, Commerce, and Shipping* (1833), Parliamentary Papers, 1833, VI, 340, 356, 364, 459–464, 468, 476–477.
[5] Clapham, *An Economic History of Modern Britain*, I, 9–15.
[6] Statement of James Alexander, timber merchant, *Report on East India-Built Shipping* (1814), Parliamentary Papers, 1813–14, VIII, 156.

faire the price of timber which would have been sufficient to maintain on a sustained-yield basis an adequate timber supply was far higher than British shipping could support so long as virgin forests remained available on the seaboard in America and elsewhere and the rate of depletion of these forests continued to be high. This price level was never reached in Great Britain.

The western European shipyards consequently were forced to depend extensively on distant sources of supply for ship timber after the American Revolution. Much hull timber came from the great forests of eastern Europe by way of Danzig, Stettin, Riga, St. Petersburg, Stockholm, Gothenburg, and Hamburg. An elaborate and costly mercantile organization arranged for the cutting, hauling, and grading of this material and for its shipment to the shipyards in great lumber carriers. Other sources which were tapped were Switzerland, Italy, and the Dalmatian coast. Many cargoes also crossed the Atlantic, although freight charges were substantial. Britain, under the stimulus of her timber duties, imported a considerable amount of oak from Canada, although the cost of shipment was considerably greater than that of Baltic timber. A large number of cargoes of American live and white oak also were imported by English and Continental shipbuilders. The importation of teak planking from Sierra Leone and India also began on a large scale at this time, for the supplies of plank stock in western Europe were seriously depleted. Although the properties of teak had been known for some time and it had been extensively employed in Indian yards, it was not until about 1800 that it was used in British yards. It was generally employed as planking in first-class merchant ships after 1815. The advantages which it possessed in not rusting iron and in resisting decay and worms far better than oak or hard pine [7] subsequently made it a favorite wood during the age of composite and iron vessels.[8] Viewed from the standpoint of British yards the great superiority of teak easily offset the added cost of carriage from the Indian Ocean. Such was not the case in the United States, however, where oak and hard pine were close at hand. British builders therefore turned more and more to the construction of high-grade oak and teak vessels on one hand and low-grade fir ships on the other, whereas those in America generally built medium-grade oak

[7] Albion, *Forests and Sea Power*, pp. 35–36.
[8] *Report of the* [British] *Select Committee on Merchant Shipping* (1860), p. 18.

and hard-pine ships. Thus the western European shipbuilding industry, especially that of Britain, was forced to search the world for timber during the last years of wooden vessels.

The British government, furthermore, pursued a policy of protecting the timber trade of the Empire, which, like the American policy of protecting the iron industry of half a century later, was extremely burdensome for the British shipping industry engaged in those carrying trades in which international competition was to be met. As an offset, however, this policy undoubtedly created considerable additional employment for British vessels in the lumber trades of Canada and some of the colonies. The policy was begun during the wars of the French Revolution in order to insure the continuation of the supply of ship timber, for it was feared that the Baltic might be closed by unfriendly powers. Preferential duties favoring Canadian timber were established in order to build up enterprise in the Canadian lumber business.[9] The rate of duty on Baltic timber was pressed upward from 6*s*.8*d*. per load of 50 cubic feet in 1793 to 54*s*.8*d*. in 1811, and to the extraordinary height of 65*s*. in 1819.[10] At the latter rate the duty accounted for about one half of the cost of timber to the shipbuilders, and therefore was extremely burdensome. It is said to have actually been profitable to ship Baltic timber to Canada and back to England in order to avoid the duty. As a result of these duties a substantial diversion of the demand from the Baltic was created. By 1821 three fourths of the British timber imports came from the colonies, chiefly Canada. There is little doubt, therefore, that prices were raised by about the amount of the duty. In 1821, as a result of agitation by shipping interests faced with international competition, the duty on Baltic timber was reduced to 55*s*., but a new levy of 10*s*. was placed on Canadian supplies. These charges remained high until the years 1847 and 1848, during which, in one of the leading reforms of British commercial policy, they were reduced, finally standing at 15*s*. for Baltic timber and 1*s*. for Canadian timber.[11] Although reduced again in 1851, these duties were not finally abolished until 1860. From the standpoint of furthering naval security these measures were probably justifiable, but their continuation in time of peace

[9] Albion, *Forests and Sea Power*, p. 401.
[10] Clapham, *An Economic History of Modern Britain*, I, 237–238.
[11] Clapham, *An Economic History of Modern Britain*, I, 498.

seriously interfered with the development of the British merchant marine. Only those owners who engaged in the timber trade benefited substantially, but these generally operated the poorest class of vessels in the British marine. The policy of securing partial self-sufficiency in the supply of ship timber within the Empire therefore seriously handicapped British shipping, which was the chief competitor of that of the United States during this period.

2

It is difficult to measure the differential in timber costs which existed in favor of American shipyards during this period, but it doubtless was substantial. A wide variation in costs existed in the United States. Builders in the rural areas often cut their own timber during free periods, especially in winter, and hence could operate cheaply, particularly if they owned woodlots. The advantages of selecting trees personally, of being able to haul stock to the yard in the rough state, and of being able to make greater use of the durable heartwood are also difficult to estimate. During the early years of the nineteenth century builders who bought their oak timber appear to have paid from $15 to $25 per hundred cubic feet, although there were wide variations,[12] whereas those who cut it themselves paid from $3 to $4 per cubic foot for stumpage. Elm for keels and maple, beech, and birch for futtocks cost somewhat less. In contrast, prices for hewn oak timber in England appear to have been from two to five times as high, depending on the yards compared, the time, and the size and kind of wood. At the peak in 1811 large British frame timbers cost builders well over $100 per hundred cubic feet.[13] In the 'thirties and 'forties American builders paid from $30 to $45 per hundred cubic feet, and at this time British costs were reckoned to be about double.[14] American yards also possessed a marked advantage over those of continental Europe, with the exception of those located in the Baltic ports in which the timber situation was favorable. It is thus evident that in the matter of timber costs American shipbuilders had a significant advantage over most of their rivals.

[12] Prices in the Boston and Hanover areas about 1817 were about $6.00 per ton for white oak, or $15 per 100 cubic feet. See Briggs, p. 313; French, pp. 4–5.

[13] [British] *Report on East India-Built Shipping* (1814), pp. 151–152.

[14] *Report of the* [British] *Select Committee on Manufactures, Commerce, and Shipping* (1833), p. 422; Historical Statement on Live Oak (1832), p. 198.

In other important respects, however, American shipbuilders were at a disadvantage. Labor was from 20 to 30 per cent cheaper abroad because of the large supply there relative to that of land and natural resources. Many of the other materials used in ship construction were also cheaper. This was especially true of the ironware, which in consequence of the growing use of coal in smelting became much cheaper abroad, especially in England, where iron ore and coal lay in close proximity to each other. Nearly all of the iron and a number of other products used in shipbuilding were imported by American shipbuilders during the entire period before the Civil War. The costs of transportation, and the rising duties engendered by the protectionist movement were a serious menace, therefore, to the competitive position of the American maritime industries. In the Tariff Act of 1816, hammered bar iron was taxed at 45 cents per hundredweight, which was about 20 per cent of its price. This duty was raised to 75 cents in 1818, 90 cents in 1824, and $1.12 in 1828. The ad valorem charge on iron in its various forms ranged between 40 and 100 per cent of the value of the material abroad throughout the period from 1818 to 1832.[15] Thus began a conflict between the manufacturing and shipping interests which was vitally to affect American maritime development. Fortunately, during this early period of high protection, iron was not an important item in shipbuilding either in the hull or rigging, although it later became a most important material. In general, the advantage in the matter of timber costs greatly outweighed these disadvantages.

The shipbuilders found cause to protest vociferously, however, against the rise of protectionism, and against the duties on shipbuilding materials. Those at Philadelphia, for example, complained in 1830 that they were "suffering under the pressure of the present high rate of duties on the raw materials used in building and equipping ships or vessels, which high rate of duties they firmly believe[d] to be also burdensome and injurious to those [shipbuilding] interests of the entire nation." [16] Although this handicap was not sufficient vitally to restrict American navigation, it is plain that in this case the normal influence of protective duties on export industries was to be found. Because of their competitive nature, the shipping and shipbuilding industries

[15] Taussig, *Tariff History*, p. 52.
[16] *Memorial of the Shipbuilders of Philadelphia* (1830), p. 2.

have always felt the heavy weight of protectionism, and the case of the United States was no exception.

The net result appears to have been that American shipbuilders secured a marked advantage in the total cost of construction over those of Great Britain and western continental Europe. A comparison of vessel prices is always extremely unsatisfactory because of the wide variations possible in timbering, fastening, finish, design, and outfit. Nevertheless, it seems to have been generally agreed during the first half of the nineteenth century that American wooden vessels were both good and cheap. Prices appear to have ranged between 50 and 75 per cent of those prevailing in western European ports, depending on the type of vessel compared, the ports, and the builders. Tench Coxe wrote in 1791 that "the best double-decked ships, with live oak lower timbers, and red cedar top timbers, and with white oak plank on their bottoms, and either that timber or yellow pine for their sides, can be built and fitted for taking in a cargo at $34 per ton, and as good a vessel cannot be procured in Great Britain, France, or Holland under $55 to $60."[17] Less elaborate vessels, built of white oak alone or of other materials, could have been had at considerably less, especially from the yards in the rural areas. By the early 'thirties the margin had, perhaps, narrowed somewhat. British-built vessels then cost between £10 and £25 per gross ton, the latter figure being for ships of the best class of oak and teak construction.[18] This latter price, which was equivalent to about $120 per ton, substantially exceeded that of the best American ships, which rarely cost over $55 per ton. Ordinary American freighters then sold at prices ranging between $35 and $50 per ton. The British parliamentary inquiries established again and again during this period that the primary handicap facing British shipping in the transatlantic trade was the high cost of British-built vessels in comparison with that of American-built ones. What was true of British shipping was also true, although in some cases to a less degree, of French, Spanish, and Dutch shipping.

[17] Tench Coxe, p. 83.

[18] *Report of the* [British] *Committee on Manufactures, Commerce, and Shipping* (1833), pp. 347, 420–425.

3

There are other evidences that western Europe was at this time economically unsuitable for shipbuilding. The shipyards engaged in building large ocean-going vessels were, on the whole, unprofitable enterprises, and building consequently tended to stagnate. The protected carrying trades of the chief powers provided the chief sources of demand, but the effect of the expansion in commerce on these routes was offset by losses in business elsewhere. In Great Britain the parliamentary investigations showed that a serious state of affairs existed by the early 'thirties because of the competition of American and Baltic vessels in the international carrying trades, and of the sale of colonial-built craft in the British ship markets. Many new British-built vessels were being sold at a loss by their builders. Construction activity was being restricted in many cases to the building of vessels for services in which international competition was not severe, or was absent altogether, such as the Far-Eastern carrying trades. Indeed, it was only with difficulty that the shipbuilding industry continued to function in many places, especially in Liverpool, Sunderland, and the Channel Ports, where most of the cheap British tramps were constructed.

Consequently in England the output consisted primarily of two types of vessels. The first was the high-quality ship, which was usually of large size, solidly built of oak and teak, coppered and copper-fastened, splendidly finished, and generally supplied with a double outfit of sails, rigging, and other appurtenances. In the construction of vessels of this kind British yards had some advantage, for in this kind of work skilled labor was relatively important. It was generally believed that Canadian yards could not turn out vessels of this type, both because of the difficulties of securing such durable timber and because of the lack of sufficient skill among the masters and men. Most of the vessels of this type built in England were intended for the carrying trades to the Far East. The East India Company, which still maintained a portion of its monopoly and hence could afford to pay well, ordered a large number of such craft, most of which were built in the great London yards, such as those of Wigram & Green and J. Barnard. Between 1795 and 1813 there were built in the important Thames yards for this company alone 98 vessels totaling

98,717 gross tons.[19] There were also built 542 vessels, totaling 41,552 gross tons, for other owners. In 1814 over 2500 workmen were engaged in building ships for the East India Company alone. The United Kingdom yards also excelled in warship construction, and frequently succeeded in exporting such vessels despite their high prices. American shipbuilders did only a small business along these lines, in which they had had little experience. The second type was the small cheap ship for the coastwise and short-voyage trades. Such vessels, which were too small for the Atlantic carrying trades and were specially adapted to the needs of British trade, were usually built of fir and other cheap low-grade materials, and were constructed mainly in Sunderland.[20] The builders of these ships complained bitterly, however, of the sales of cheap Canadian vessels, and of the scarcity and high cost of wood. By 1833 many were losing large amounts of money and were abandoning the business.[21] In the construction of large durable freighters for the primary world carrying trades, such as were then being built in the United States, British builders were hopelessly outclassed.

Additional evidence showing the economic disadvantage of western European yards may be found in the tendency of the industry within the British Empire to migrate to Canada and other parts of the Empire where timber supplies were more plentiful. This movement did not reach its peak, however, until after the middle of the nineteenth century. In Canada, which was well supplied with forests, the industry had remained small until the British market was closed to the United States builders in 1786, although there had been some building under the French at Quebec beginning as early as 1732.[22] After the Revolution it sprang up along the upper reaches of the St. Lawrence River and in the Maritime Provinces. This area abounded in timber,[23] but much of it consisted of spruce and other inferior maritime woods, although considerable white oak was obtained along the upper portions of the

[19] [British] *Report on East India-Built Shipping* (1814), pp. 2, 16, 78.

[20] *Report of the* [British] *Select Committee on Commerce, Navigation and Shipping* (1833), pp. 420–425.

[21] *Report of the* [British] *Select Committee on Commerce, Navigation and Shipping* (1833), pp. 420–425.

[22] Wallace, *Wooden Ships and Iron Men*, pp. 8–9.

[23] A. R. M. Lower, W. A. Carrothers, and S. A. Saunders, *The North American Assault on the Canadian Forest* (1938), *passim.*

St. Lawrence. Secondary timbers, such as maple, birch, and hackmatack, were the woods most commonly used in the frames, and in the early period of development even this timber was not seasoned. Consequently Canadian-built vessels long had an evil reputation among both American and English builders because of their short life and poor construction. They could, however, be built and delivered to European owners very cheaply. In the early 'thirties Canadian-built freighters were being sold in Liverpool at less than half the price of British-built ones.[24] This differential was more than enough to offset the inferiority of construction. The best Quebec-built ships were then priced at about £10 per gross ton and the poorest at about £6, which figures were far below the price range of £10–£15 per gross ton prevailing in England.[25] Consequently a strong demand developed, and the exportation of vessels became a leading business in Canada, as it had a century earlier in New England. Some yards had English connections for which they regularly built on order, but the majority laid down vessels on speculation and sent them to England laden with the ever-present lumber cargo. Later Canada was to produce higher-grade vessels. Canada thus became a substitute for the former Thirteen Colonies, but the Canadian yards never developed such excellent designs or such vigor as those of the United States.

Shipbuilding also developed in India, where teak, the most durable maritime timber in the world, was to be had. During the difficult days of the Napoleonic Wars the Royal Navy placed orders in India, beginning in 1803.[26] Subsequently many of Britain's best war vessels came from the Bombay yards, where skilled Indians worked under British constructors. The first merchant ship built in India for British account was launched in 1794, and by 1813 seventy-six merchant vessels totaling 47,475 gross tons had been completed.[27] Indian-built vessels were of high quality and were somewhat cheaper than British-built ones, although the iron, copper, pine masts, sails, rigging, and armament had to be sent out. However, although many vessels came from

[24] *Report of the* [British] *Select Committee on Commerce, Navigation, and Shipping* (1833), p. 423.

[25] *Report of the* [British] *Select Committee on Commerce, Navigation, and Shipping* (1833), p. 423.

[26] Albion, *Forests and Sea Power*, pp. 366–369.

[27] [British] *Report on East India-Built Shipping* (1814), pp. 14–15.

the yards of India, including the famous clipper ship *Tweed*, only a small portion of the British tonnage was built there, for the supply of teak was not unlimited and the demand for high-grade teak ships, which were more costly than American oak vessels, was seriously restricted.

A large proportion of the merchant tonnage of the British Empire was, in fact, built in the colonies and possessions during this period. During the decade 1815–1824 alone, 237,845 gross tons were built there compared with 785,406 gross tons in the United Kingdom. In the next decade, 1825–1834, the figures were 545,137 and 956,753 gross tons respectively.[28] The advantage which maritime Britain secured from her Empire was, therefore, substantial.

4

In contrast to the situation in the British dominions, the comparative advantage of the American shipyards did not result in heavy sales abroad, largely because of the protective policies of foreign nations. To these restrictions the American merchant marine, in fact, largely owed its prosperity, for in other respects its competitive advantage was slim. Since sales of colonial vessels to British owners had played a large part in the colonial balance of payments, an effort was made in the American Tonnage Act of 1789 to encourage the exportation of new vessels by giving foreign-owned, American-built vessels preferential port dues in comparison with foreign-built and foreign-owned ships.[29] This device was ineffective, however, and hence the sale of American-built vessels was confined mainly to minor foreign markets until the early 'fifties, when extensive sales in England were resumed.

The most important American ship markets were in the West Indies and South America, where in many places there were no restrictions on purchases. The customs house returns fail to give the flags of the buyers or reasons for the sales, and hence an appraisal of this aspect of American shipbuilding is difficult. It is evident, however, that small American-built schooners and brigs of from 40 to 200 tons were sold for use in local trade, especially at Havana, Pernambuco, and Rio de Janeiro. During this period, in fact, a large proportion of the American tonnage sold consisted

[28] A.R.C.N., 1901, p. 473.
[29] 1 U. S. Stat. 27.

of vessels of this type. For instance, in the year 1818, sixty-two schooners, fourteen brigs, and four sloops, but only fifteen ships, were sold abroad.[30] Many of these vessels were evidently built on speculation, and were sailed south loaded with fish, lumber, or provisions to be sold. Some were even carried out in knocked-down condition in the holds of larger vessels. Shipowners located in the West Indies and South America made considerable use of American shipyards, but lack of capital and high costs of operation prevented any large demand from arising in this region.

Part of this foreign business, unfortunately, consisted of the construction and sale of slavers, of which the United States was the primary source of supply because of the low prices at which they could be secured, the superior models available, and the lax control exercised by the government regarding the fitting out of such vessels. The very sharp Baltimore clipper schooners and brigs were in great demand on this account.[31] These vessels were sailed south in large numbers consigned to the slaving houses in Havana, Rio de Janeiro, and Pernambuco for sale, delivery to be made there or on the African coast. Fast sailing vessels often brought extremely profitable prices, and the construction of such vessels was consequently stimulated.[32] Indeed, it is probable that some American builders were more or less ignorant of the source of the demand for vessels of this type. Whatever the moral aspects of this business may have been, naval architecture and shipbuilding were stimulated.

American-built vessels were also sold in other far-flung markets. A number of large ships and brigs were sold in Amsterdam and other Dutch ports during the temporary relaxation of the Dutch registry laws between 1815 and 1819.[33] Others, chiefly small craft, were sold in the Pacific at such places as Valparaiso, Lima, Panama, Hawaii, and Canton.[34] Many of these vessels were

[30] R.C.N.T. (1818); in A.S.P., C.N., vol. II, no. 227.

[31] *Report of the Secretary of State on the Search or Seizure of American Vessels on the Coast of Africa* (1841), House Exec. Doc. no. 115, 26 Cong., 2 Sess., pp. 4–6, 106, 226–227, 255, 471–476, 556–557.

[32] Henry A. Wise, U. S. Minister to Brazil, *Dispatches Relative to the Slave Trade* (1845), House Exec. Doc. no. 148, 28 Cong., 2 Sess., pp. 75–83.

[33] *Report on the Commercial Regulations of Foreign Countries* (1819), Senate Doc., 16 Cong., 1 Sess.; in A.S.P., C.N., vol. II, no. 223, p. 354.

[34] Dispatch of B. C. Wilcocks, U.S. Consul at Canton, *Report on Distressed American Seamen in Foreign Ports* (1817), House Doc., 14 Cong., 2 Sess.; in A.S.P., C.N., vol. II, no. 204, p. 50.

extremely small, thus showing the enterprising spirit of American owners, builders, and captains. For instance, we find recorded the sale of the new schooner *Eos*, 86 tons, in Hawaii in 1819,[35] the brig *Neo*, 162 tons, in the same place in 1821,[36] and the brig *Rubicon*, 144 tons, at Lima in 1823. Many of these vessels were operated for several years before sale. Frequently these vessels were sold as part of the plan of commercial operations of their owners.

The amount of tonnage sold abroad, both new and old, was relatively small, however, compared with the amount constructed. From a high 23,379 gross tons in 1816, sales declined to 5710 tons in 1822, and then slowly rose to a peak for the 'twenties of 19,043 tons in 1827, after which a sharp decline again occurred. During this period, the total output of sailing vessels ranged between 154,624 gross tons in 1815 and 47,784 gross tons in 1820. There is ample evidence, however, that, but for the policies of autarchy abroad, foreign sales would have been much larger, reaching, perhaps, 150,000 gross tons annually.

5

During the early national period the science of naval architecture made considerable progress in the United States, although the great achievements of the wooden age in America were still some distance away. The techniques employed in most yards were still mainly empirical, but builders were showing more tendency to experiment and improve on existing models than before. Prosperity, keen competition, and expansion attracted many excellent men into the industry, both from domestic sources and from abroad, with the result that a broader base was laid for technical advance. Efforts were made to adapt American designs to the needs of American commerce in so far as the master builders had the ability to do so. Considerable success was achieved along these lines, and American vessels began to assume distinctive forms.

American shipowners required, in general, small, seaworthy, agile, durable, and inexpensive vessels capable of cruising for great distances. Much of American trade was conducted on relatively long oceanic routes, and hence seaworthiness, economy, and

[35] Boston Registers and Enrollments, 1818, register no. 183.
[36] Boston Registers and Enrollments, 1818, register no. 211.

endurance were essential in the vessels. It was a highly dispersed trade, for vessels sailed from nearly all of the several hundred domestic ports for innumerable trading centers overseas. The volume of cargo available at any given time in many of the domestic and foreign ports was often small, and hence large vessels were likely to be a handicap to owners desiring to keep their vessels on the move. Many owners also could not afford to build and maintain large and expensive vessels, and there were few economies to be secured by so doing.

Consequently the typical vessel of the American merchant marine during this period of dispersed trading operations was the small ship, brig, or schooner of from 100 to 300 gross tons register. Such vessels were extremely handy, for they could readily enter and leave shoal harbors, whereas larger vessels might have to lie outside for some time. The small size and depth of many active American ports at this period was an important factor in this connection, for in many only very small vessels could be handled. In addition, small ships could more readily maneuver in narrow waters, and consequently could enter a port, transact their business, and depart with a celerity which more ponderous vessels could not equal. Officers of the British East India Company remarked that much of the advantage secured by American vessels in the East India trade was due to their superiority in this respect.[37] In this area many of the principal ports, such as Canton, Surat, and Calcutta, lay far up rivers the navigation of which was difficult. British vessels trading in the eastern seas were never less than 350 gross tons in size, and frequently were much larger. In 1821 the East India Company was employing in the China trade forty-three vessels, of which the largest, the *Earl of Balcarras*, was of 1417 gross tons and the smallest, the *Lady Campbell*, was of 684 tons, the average being about 1200 tons.[38] In contrast it was estimated that seventy-seven American vessels sailing from Batavia in 1820 averaged but about 300 tons.[39]

Small vessels were also more suited to the needs of American merchants. Since many vessels were employed in private trading

[37] *Report of the* [British] *Lords' Committee on the Trade with the East Indies and China* (1821), Parliamentary Papers, 1821, VII, 16–17, 68.

[38] Memorandum of M. C. Grant, Director E. I. Co., [British] *Report on Trade with the East Indies and China* (1821), pp. 162–163.

[39] [British] *Report on Trade with the East Indies and China* (1821), p. 16.

voyages conducted by their owners, the business needs of such owners were a limiting factor. American trade was still dispersed, spasmodic, and speculative, and hence large-scale operations were rare. Merchants also sought for a diversification of their risk. Furthermore, the absence of extensive shore establishments abroad made the use of the small craft desirable, for smaller fees to local agents were required.[40] Consequently a typical American shipping firm chose to employ two 350-ton vessels rather than one of 700 tons, and hence few of the latter size were built in the United States during this period. Not until the development of a large-scale bulk-cargo traffic in the late 'thirties did the size of American vessels begin to rise.

American merchant ships were not highly specialized during this period. Consequently it is most convenient to classify them in certain general groups. First, we may list the large freighters of from 300 tons up to about 500 tons, which were generally stout, full-bodied, ship-rigged craft, and were primarily employed in the off-shore carrying trades, especially that to Europe. Second, there were large numbers of small off-shore freighting vessels of from 100 to 300 tons, which were rigged as ships, barks, brigs, and schooners and were employed in innumerable small carrying and trading operations in the coastwise, West Indian, European, and East Indian trades. Third, there were many vessels designed for the short-voyage coasting trades. These were mainly small, shoal-draft brigs, schooners, and sloops. Fifth and sixth, respectively, there were numbers of more or less specialized whaling and fishing craft. It should be recognized, however, that vessels were readily shifted from one employment to another at this time, and that the 70-ton schooner could compete with the 600-ton Indiaman in distant trades. Fishing schooners often entered the foreign and coastwise trades in the off-season, many old merchantmen became whalers, and small vessels of all types showed up in the far away eastern seas.

The typical large American merchant vessel of the early national period was the deep, burdensome, full-rigged ship, which carried three masts, all of which crossed yards, and which usually had two decks. Soon after the Revolution the raised quarter deck, rising poop, ornamented quarter galleries, bridge-type forecastle,

[40] Statement of Captain J. R. Oliver, shipmaster, [British] *Report on Trade with the East Indies and China* (1821), pp. 62–63.

and heavy "beak," which had been found in many large colonial vessels, began to disappear, with the result that the ship of the early nineteenth century usually had a flush deck, the sheer of which was very slight, a straight, nearly vertical stem, and a broad square stern.[41] The bows were still very square in order to give buoyancy and carrying capacity and to allow of the ready use of bow guns.[42] The large vessels were generally distinguished from the small ones more by greater depth of hull than by increased length, with the result that the models of these ships were relatively short and deep and the ends were short and full. These vessels required a large amount of canvas to drive them, but because they were still relatively small the size of the individual sails was such that the vessels were handy with small crews. The majority of American vessels were rather dull sailers, however, especially to windward. These vessels were, on the whole, strong and durable, but were undistinguished in model and performance.

The size of the American full-rigged freighter did not tend to increase significantly between 1789 and 1815, and hence most vessels were extraordinarily small, compared with both the wooden and iron sailing vessels of the following half century. Comprehensive figures are not available, but it is evident that a ship of 400 tons was a large vessel, and that vessels of from 600 to 1000 tons were exceptional. For example, the average size of the twenty-eight full-rigged ships built in the active shipbuilding center of Kennebunk between 1800 and 1815 was 244 tons, the largest being the East Indiaman *Rubicon*, 408 tons, built in 1811, and the smallest the *Washington*, 193 tons, built in 1805.[43] In the Portsmouth district the largest vessel built during the same period was the *Fabius*, 460 tons, which was constructed by James Tobey at Berwick in 1811, and the average size of the largest full-rigged ships built in each of the fourteen years when such ships were built in the district was only 338 tons.[44] Enos Briggs, Salem's leading master builder, constructed twenty-three ships between 1791 and 1815, the average size of which was 315 tons,

[41] Compare the numerous photos of old paintings of ships in J. Robinson and Dow, *The Sailing Ships of New England*, ser. III, esp. nos. 644, 646, 652, 653.

[42] Sir J. S. Pakington, "Inaugural Address to the Institution of Naval Architects," *Trans. I.N.A.*, I (1860), 5.

[43] Compiled from Bryant.

[44] J. Edmonds, *Portsmouth City Directory* (1839). This work contains a list of vessels built at Portsmouth. No ship was built in 1813.

the two largest being the frigate *Essex*, 850 tons, built in 1799, and the East Indiaman *Grand Turk*, 560 tons, built in 1791, and the smallest the *Benjamin*, 161 tons, built in 1792.[45] The high-water mark in the building of big vessels appears to have been reached in 1811 when the new East India trade was very active. Subsequently, a marked trend toward smaller full-rigged ships became evident, although the extremely small vessel of this type largely disappeared.

A comparison of the post-war with the pre-war years also reveals little change in vessel sizes. At Kennebunk, the average size of eleven ships built between 1815 and 1829 was 320 tons, the largest being the *Sabine*, 439 tons, and the smallest the *Maine*, 294 tons. At Portsmouth no vessel exceeded 400 tons until 1824, when Jacob Sheafe completed the 402-ton *Sarah Sheafe*.[46] At New York, a center of large-vessel construction, the average size of ships built during the years 1815–1817 inclusive was but 373 tons, the maximum being 899 tons, and the minimum 176 tons.[47] Boston's largest ship in 1815, an active year, was the *Union*, 620 tons.[48] Some indication of the trend of American construction may be obtained from the following table, which covers four typical eastern shipbuilding centers.

TONNAGE OF FULL-RIGGED SHIPS BUILT IN CERTAIN EASTERN PORTS IN 1815 AND 1825

	Boston		*Portsmouth*		*Kennebunk*		*Hanover*	
	1815	*1825*	*1815*	*1825*	*1815*	*1825*	*1815*	*1825*
Largest	620	396	378	403	439	288	464	295
Average of 3 largest	473	386	350	378	373	285	407	295
Average	390	358	350	365	373	285	358	295
Number of ships	15	4	2	5	3	2	10	1

There is ample evidence that many builders were capable of constructing larger vessels, but that such vessels were not in demand. A few monsters were built, especially at New York, but these were chiefly warships. Among these may be mentioned the *Curiazo*, 851 tons, built by Foreman Cheeseman in 1817; the *Horatio*, 865 tons, built by A. and N. Brown; and the *Regulus*,

45 Leavitt, pp. 138–139.
46 Edmonds, *Portsmouth City Directory* (1839).
47 Albion, *Square-Riggers on Schedule*, pp. 13–14.
48 Boston Registers and Enrollments, 1815.

872 tons, built by Henry Eckford. Several huge vessels were also built at Philadelphia. Such craft were exceptional, however, both in shipbuilding and in ship operation in the United States during this period.

During this era the largest and best vessels built in the United States were the East Indiamen, which were principally the products of Massachusetts yards, and the North Atlantic packets, which were mainly built at New York. The owners of such vessels were normally in a position to bear special expense and their requirements were extremely exacting. Ships for the East India trade, which was opened in 1784, came to be especially strong, durable, well finished, and well outfitted because of the length of the voyage, which required two or more years, the relatively high values of the cargoes carried, and the wealth and dignity of many of the firms which came to own such vessels. The ships of E. H. Derby, Russell & Company, and Bryant & Sturgis, for example, were among the finest of this era. The East India trade required mercantile ability, diplomatic skill, and seamanship of a particularly high order, but those who were successful achieved large profits. Hence great pains were taken to secure suitable craft. Such vessels were somewhat above the ordinary American freighters in size, but few could rival the great vessels of the European companies, whose ships ranged from 600 to 1400 tons.[49] Among the large American Indiamen may be mentioned the *Massachusetts*, 800 tons, built by Daniel Briggs at Quincy in 1789, the *Grand Turk*, 560 tons, built by Enos Briggs at Salem in 1791, and the *Ann and Hope*, 550 tons, built by Benjamin Tolman for Brown & Ives of Providence in 1798. Such vessels were, in general however, too large for the American carrying trades, and hence were unpopular, although a few were used in general trading operations by the wealthiest maritime merchants.[50] The armaments of American Indiamen were always heavy, for privateers, pirates, and other enemies were often met. Usually only the best builders possessing the highest reputations received orders for such craft. These were chiefly located in Boston, Medford, Hanover, Salem, Newburyport, New York, and Philadelphia. Construction was commonly closely supervised by the owners or their

[49] [British] *Report on Trade with the East Indies and China* (1821), pp. 162–163.

[50] R. E. Peabody, *The Log of the Grand Turks* (1926), pp. 112–114, 149–151; R. B. Forbes, *Notes on Ships of the Past* (1885), pp. 50–51.

captains, for an East India voyage was a major undertaking both of trade and seamanship. It is impossible to determine how many East Indiamen were built, but during the early years of the century the established houses in the trade secured a considerable number annually. The business of building these vessels began to decline after 1820 to some extent because of the rapid reëstablishment of normal commercial intercourse between Europe and the Orient, and the rise of protectionism in the United States. During the first three decades of the century, however, these ships were the foremost vessels of the American merchant marine.

The vessels which carried on the North Atlantic passenger trade also began to be distinguished from the ordinary tramp freighters during this early American period, and by 1830 had reached a position of primacy which they have not yet relinquished. Before 1815 the term "packet" indicated a vessel, often of a superior class, which was a common carrier on a particular route and usually carried both passengers and freight in a more or less regular service. Most of the American packets were small sloops and schooners which maintained regular services in the short-voyage coasting trades. There were also a few British and French government packets in the transatlantic trade. By 1830 lines of large American packets were operating on fixed schedules on the difficult north Atlantic routes, and were offering special advantages both in speed and accommodations. An intense competition among the shipbuilders engaged in the construction of these liners consequently began, and this competition did much to develop American naval architecture. Only the very best vessels could survive in this trade, for the packets were sailed to the limit by their hard-driving officers, and obsolescence was rapid. Valuable lives, specie, mail, and goods were entrusted to them. Speed, weatherliness, durability, and finish were, therefore, the primary requirements. The Atlantic packets consequently supplanted the Indiamen as the outstanding ships in the American merchant fleet.

Many of the packets had live oak frames, which were spaced close together, extra heavy scantlings, complete inside "skins," and copper fastenings. In model they came more and more to resemble the fast-sailing frigates rather than the ordinary clumsy freighters, for their floors had considerable deadrise, the bilges were nicely turned, the bow was cut away forward to give easy lines, the run was long and sharp, and the decks were generally

flush. Although not capable of high speeds, their size and model enabled them to be driven easily at rates not exceeding twelve knots, and hence they usually made good passages. Aft in the cabin, accommodations for from ten to twenty-four passengers were provided, generally in two-berth cabins, and immigrants, who were not yet arriving in large numbers, were quartered in the 'tween decks. These poor people were expected to bring their own food and bedding, do their own cooking by turns at the galley, and put up with the bad conditions which resulted when the hatches of the lower decks were battened down in bad weather, which sometimes lasted for many days. In size the Atlantic packets increased from about 300 tons in 1815 to as much as 600 tons in 1830. The sizes of the largest vessels in service out of New York to Liverpool, London, and Havre in the latter year were 647, 492, and 496 gross tons respectively.[51] The increase in the size of the packets is shown in the following table.

AVERAGE TONNAGE OF NORTH ATLANTIC PACKET SHIPS BUILT, BY FIVE-YEAR PERIODS, 1815–1829[52]

	Packet Ships		Black Ball Line	
Years	*No.*	*Ave. Tonnage*	*No.*	*Ave. Tonnage*
1815–19	18	366	3	406
1820–24	31	437	6	522
1825–29	15	561	3	612

The construction of the packet ships early became centralized in the large cities, especially New York, where a limited number of builders had acquired the technical ability, skilled labor, supplies, and prestige essential for this work. The New York builders were probably aided by the greater facility for securing live oak which existed at that port. At all events, of the seventy-six ships built for the New York packet service between 1818 and 1832, sixty-eight came from the yards of New York City, and of these twenty came from the Bergh-Westervelt yard, fourteen from that of Brown & Bell, and eight, seven, and six from those of Sidney Wright, A. & N. Brown, and Fickett & Crockett, respectively.[53] It is therefore evident that a considerable amount of specialization

[51] Albion, *Square-Riggers on Schedule*, p. 274.
[52] Compiled from Cutler, Appendix 1 b.
[53] Albion, *Square-Riggers on Schedule*, p. 276.

in shipbuilding developed in the United States at an early date.

Another feature of American shipbuilding after 1815 was the popularity of the large full-rigged brig — a two-masted, square-rigged vessel of from 150 to 200 tons — among the owners engaged in almost all of the foreign and domestic carrying trades. In general these vessels were cheaper to build and operate than full-rigged ships, yet were very seaworthy and handy. Many were strong, powerful, and handsome vessels. Between 1820 and 1829, 1258 such craft were built, compared with but 542 ships.[54] Although the size of the brig was increased in later years, this type of vessel was overshadowed by the large full-rigged ship as soon as bulk cargoes became available in quantity. But for the time being it was the most suitable type of craft for the small-scale and dispersed operations then conducted by most American owners and merchants.

Many smaller craft were also in demand. Square-topsail schooners, most of which ranged between 75 and 150 tons, were used for a time in the offshore trades, especially those to the West Indies and Mediterranean. After 1815 these craft were slowly superseded by brigs. The big sloop with square topsail, formerly a popular type, was soon shown to be too small for offshore work, and hence became rare after 1825, although several such craft had made long voyages. Among these was the *Experiment*, 83 tons, which went to China in 1785. Prior to 1812, however, it was a common type. In the short-voyage coastwise carrying trades small brigs, two-masted schooners, and fore-and-aft rigged sloops, ranging in size from 50 to about 200 tons, were widely used. The ability to enter small waterways and to reach shallow docks was the primary requirement for vessels engaged in handling the diverse small-scale local trade of the seaboard. These small fry were undistinguished, but collectively were important.

6

American merchant ships may be classified, as to model, as sharp- or Virginia-built, frigate-built, and full-built. The vast majority were of the last type. The chief purpose of most owners was to carry large cargoes at low cost, and speed was of secondary importance. This aim could best be accomplished by making the hull short and deep, the ends full, the bottom relatively flat, and

[54] A.R.C.N., 1901, p. 581.

the bilges hard. The cost of construction, which was primarily proportional to the length because of the expense of fashioning the additional frames required for long ships, could thus be minimized. The admeasurement rules also greatly stimulated the construction of this thoroughly clumsy, unweatherly, and slow type of vessel. Lauchlan McKay wrote that "according to our present law, like that of the English, you can build a double-decked vessel a mile high, and she will not measure one ton more than though she were but 20 feet." [55] This was because the depth was arbitrarily taken to be one-half of the breadth.[56] Neither was any allowance made in the formula for sharp ends.[57] Consequently considerable sums in port charges could be saved by maximizing the internal volume on a given length and beam. Only in special cases were extensive departures from this practice made. The builders in both England and America were quite aware of the evils of this rule of measurement, as is shown by the fact that war vessels were free from these defects,[58] but commercial competition forced owners to order unwholesome designs.[59] Not, indeed, until 1864, when the American marine was under pressure, was a more satisfactory rule adopted. Large early-American vessels were typically between 90 and 120 feet in length, 28 and 32 feet in beam, and 14 and 25 feet in depth. Generally depth was increased more than the other dimensions as size was increased. It was in such clumsy, though cheap, sailers that the bulk of American seaborne traffic was carried.

American cargo ships had therefore little to recommend them other than their price. Rule-of-thumb methods of design were widely used, as has been shown, with the result that many builders were basically dependent on previous models or on published English tables of offsets and plans. The designs were therefore primarily of English origin, and these were found to be so bad by a

[55] L. McKay, p. 85.
[56] 1 U.S. Stat. 55 (1789).
[57] The formula for tonnage used was:

$$\frac{(\text{length} - 3/5 \text{ beam}) \times \text{beam} \times \text{depth of hold}}{95}$$

Generally the depth was taken as one-half the beam, but this practice was slowly abandoned. This was called the old measurement rule after new methods were adopted in Great Britain in 1854 and in the United States in 1864.

[58] J. Wooley, "The Present State of the Mathematical Theory of Naval Architecture," *Trans. I.N.A.*, 1 (1860), 24.
[59] Griffiths, *Treatise*, pp. 47–56.

Royal Commission that it was decided in 1810 to establish a college of naval architecture in England at the Portsmouth Dockyard.[60] The construction work on American vessels was also indifferent at times. The freighters of this period were thus of unexceptional design and build.

A distinctive product of the American industry, however, was the sharp-built vessel, the development of which was stimulated by privateering, smuggling, and slaving.[61] These vessels were distinguished by their knife-like bows, very easy lines, long clean run, large amount of deadrise, and small carrying capacity for their length. In many respects they resembled the sharp, fast, piratical vessels of the Mediterranean. A number, carrying sloop rigs, had been built at Bermuda, beginning as early at 1750, but by 1770 the design had been copied by the builders of Chesapeake Bay, who enlarged it and altered the rig to that of a topsail schooner or brig. Subsequently, in the ship *Ann McKim* and other vessels, the design became a forerunner of that of the clipper ship. These vessels were extremely fast, and hence made excellent privateers, slavers, and war-time merchant ships. Their construction was undertaken all along the coast, but the Chesapeake Bay region remained the primary center. After the wars, when economy became more important than speed, the construction of vessels of this type greatly diminished.

The rigs of American vessels were still relatively elementary. The number of square sails carried on each mast tended in general to increase from the three of the eighteenth century to four, but frequently ships, barks, and brigs still spread nothing above topgallant sails. Forward, jibs had generally displaced square spritsails by the turn of the century. The sails were extremely small, judged by later standards. Few main yards exceeded fifty feet in length. Hence five or six men could readily reef the topsails on a full-rigged ship, and the large crews and man-driving labor policy commonly found in later days were rare. Labor problems were consequently of small importance. Full-rigged ships commonly carried from nine to twelve men before the mast, and smaller vessels were manned in proportion. Where economy of

[60] J. S. Russell, "On the Education of Naval Architects," *Trans. I.N.A.*, IV (1863), 165.

[61] For a discussion of the origins of the American sharp-built vessels see Chapelle, *The Baltimore Clipper*, pp. 9–14.

handling was of special importance the bark rig was used. This dispensed with the yards on the mizzen mast. It became increasingly popular after 1815, and, in particular, was often placed on whaling vessels. The simple schooner rig was frequently used on coasters and West Indiamen, for which ability to beat to windward was important. The problems of designing and of handling economically huge sail plans thus did not arise until a later date.

In speed the vessels of the period were still extremely slow, for few vessels, including frigates, were able to exceed twelve knots under favorable conditions. The average speed of a ship on a voyage was more likely to be under than over five knots. According to Cutler the maximum speeds recorded in the logs of the East Indiamen *Fame*, *Herald*, and *Glide* was 11 knots, in that of the sharp-built privateer *America*, 13 knots, and in those of the frigates *Constitution* and *Essex* 13.5 and 12 knots, respectively.[62] The voyage home from China required from 125 to 130 days in the favorable season and about 160 in the unfavorable one, although occasionally better passages were recorded.[63] On the North Atlantic route the packets, which were considerably faster than the freighters, required from 17 to 55 days westbound, for on this course westerly winds had to be met. The average time of the westward passage of the New York packet ships during the period 1818–1832 was 38 days each from Liverpool and London and 40 days from Havre,[64] the great majority of passages lying between 28 and 42 days.[65] The Black Ball Line during the years 1818–1827 averaged 24 days eastbound to Liverpool and 38 days westbound from Liverpool.[66] Full-bodied ships sometimes took 60 days or more westbound. Faster passages were, however, made on the eastbound route. West Indiamen normally made but three round voyages annually.[67] The small size and deep model of the vessels of this period made them extremely vulnerable to heavy weather, head winds, and lee shores. Mid-winter navigation was consequently often suspended, and as late as 1830 passages homeward from Europe were sometimes made by the southern route, frequently with a call at Charleston, as in the colonial

[62] Cutler, pp. 47–48.
[63] Cutler, pp. 80–86.
[64] Albion, *Square-Riggers on Schedule*, p. 317, Appendix XI.
[65] Albion, *Square-Riggers on Schedule*, pp. 318–319, Appendix XII.
[66] Albion, *Square-Riggers on Schedule*, p. 322, Appendix XIV.
[67] Remich, p. 173.

period. Head winds and seas sometimes held up ships for weeks. It may be concluded that American sailing ships were still far from the peak of their development, although they were probably as good in performance as most foreign ships of the period.

The typical American freighter thus does not appear to have differed greatly from her European contemporaries during this period, except for the fact that she was probably somewhat smaller. The notable advance made by the American merchant marine during this period cannot, therefore, be attributed to technical leadership, as can that of the ensuing period. The cost of construction was, therefore, the primary factor, and in this respect the advantage of the American yards, though destined to be transitory, was substantial because of the ubiquity of the timber supply.

CHAPTER VIII

THE SHIPPING INDUSTRY: TRADING SHIPS AND RECIPROCITY, 1789–1830

I

IT IS EVIDENT that the owners of vessels of the American merchant marine also possessed a substantial competitive advantage in comparison with those of the primary maritime nations of Europe. The principal problem was, therefore, to make this advantage effective. There were two serious obstacles to expansion. The first was the network of navigation monopolies and discriminations which effectively protected foreign shipping on many routes, and against some of which American shipowners were to beat in vain for many years. The second was the tendency for costs to rise during expansion because of the relative shortage of capital and labor, and of the rapid rate of depletion of the timber supply. The first obstacle was largely overcome by means of a strong navigation policy and the pioneering of new trades to South America and the Orient. The second was partly taken care of by means of a high rate of capital accumulation in the shipping centers, by the employment of foreign crews on American ships when native-born seamen became scarce, and by superior efficiency. On the whole, American shipowners were in a position to expand their operations at a rapid rate.

We have seen that American owners possessed a substantial advantage in the prices which they paid for their ships. Ordinary merchant ships were procured at figures ranging from 40 to 60 per cent of the prices prevailing in England and France. In the case of some of the home-built trading schooners this advantage was much greater, the money cost of some of these being as low as 25 per cent of the foreign price levels. In addition, there were other advantages which they obtained. American vessels generally had lighter and better equipment aloft, and the officers were accustomed to driving their men somewhat harder (this was later to become an evil practice), with the result that they were able to sail with from .5 to 1.5 men per 100 tons less than European

vessels. The general efficiency of labor on American vessels was probably higher than at any later time.[1] Vessels going to sea were able to secure capable, sober men by merely hoisting a sign, and hence resort to the boarding-house masters, who were later to become the "press gangs" of the American marine, was unnecessary.[2] The ability of the officers as navigators and seamen was also equal to the European standard, and in many cases was probably superior because many of the most capable men in American life were drawn into seafaring careers. The methods of obtaining longitude by observation remained closed, however, to many masters. On the other hand, the wages paid to seamen were somewhat higher than in England, France, Holland, Spain and Germany. The net result, therefore, was that the labor costs were approximately equal to those of British ships. Furthermore, depreciation charges were low. The superior durability of many American-built vessels, which was largely due to the use of live oak and the heartwood of white oak and to the advantages secured in selecting timber at close hand, thus counted heavily in their favor. Cargo-damage losses were also less than in many foreign merchant fleets. American vessels consequently secured freight premiums in many trades, notably in the cotton trade. Repair costs were also generally low because of the use of good timber, and of good workmanship. Furthermore, in the small sizes of vessels then in use the severe strains which later wracked large wooden hulls were not serious. American shipowners were thus, on the whole, in a very favorable position.

American vessels could make money, therefore, at comparatively low levels of freight rates, and were in a position to underbid foreign shipping, which was frequently done. For instance, in 1815 the freight rates offered by American vessels were said to be one half of those of the East India Company in the trade from the Far East to Europe.[3] In the North Atlantic carrying trades British and French ships also frequently incurred ruinous losses during this period because of the low rates offered by the Americans. Furthermore, the numerous merchants of the United States who employed vessels in trading on their own account had an ad-

[1] John Codman, *A Letter to the Hon. Charles Sumner on the Condition and Requirements of the American Mercantile Marine* (1860), p. 7.

[2] Codman, p. 7.

[3] [British] *Report on the Trade with the East Indies and China* (1821), p. 21.

vantage over many of their rivals because of the economy and efficiency of their private merchant marines. American shipping could afford to cut rates deeply in slack times in order to fill up the holds, and in boom times it made large profits out of which expansion was largely financed. It was thus far from being marginal among the world's shipping industries.

This competitive advantage was of great importance in the development of the American marine because the foreign carrying trade was the primary field of employment for tonnage throughout this period, and particularly between 1789 and 1812, when the European wars enormously stimulated both trade and neutral shipping. Although an independent nation, the United States was still primarily attached to the European economic system. To Europe the United States sent the principal products of her forests, fisheries, and land, among them wheat, rice, indigo, tobacco, cotton, lumber, and codfish, and from Europe were secured manufactured articles, iron and metal wares, cloths, and certain raw materials. The West Indies were also a vital part of the American system, for to them were sent lumber and foodstuffs, and from them were secured rum, molasses, and sugar. The division of labor in which the United States played a part therefore required the extensive use of shipping on the routes of her foreign trade. In contrast, the coastwise carrying trades, although increasing in volume, were until about 1820 of minor importance, and to a large degree were incidental to the foreign carrying trade. The proportion of the American tonnage documented for foreign trade was high prior to 1815, the percentages being approximately 62, 70, and 67 in 1789, 1799, and 1809, respectively.[4] After 1815, the proportion fell, however, the percentages for 1819 and 1829 being 46 and 47, respectively. These were still substantial. During this entire period, therefore, the state of affairs in the foreign carrying trades was of primary concern to the maritime community.

2

The nearly continuous state of violent warfare in Europe from 1793 to 1815 caused a large expansion in the American shipping industry despite high risks and severe losses. American naviga-

[4] A.R.C.N. (1914), p. 186. To a certain extent the statistics of American tonnage prior to 1818 are suspect owing to the incomplete cancellation of old certificates.

tion at first was seriously hampered by the grossly restrictive policy imposed by Great Britain after the Revolution.[5] American vessels carrying cargoes of American origin were subjected to discriminatory dues on entering British ports, and American vessels were excluded from the carrying trades between Britain and the Continent, between Britain and her colonies, between the colonies themselves, between the colonies and the United States, and from Africa, Asia, and America, excepting the United States, to Great Britain.[6] The American merchant marine consequently was stifled for a time and remained stagnant, the registered fleet being estimated to be but 124,000 gross tons in 1789.[7] The rise of the shipping industry was soon to begin, however, with the outbreak of war and the establishment of a national navigation policy.

Trouble began in France in 1789, and was followed by the outbreak of a major war between Great Britain and France in 1793. There followed a period of slow, though painful, expansion of the American shipping industry, which was beset by discriminations, illegal seizures, blockades, privateers, and pirates. American staple exports were in strong demand, however, with the result that prices were high,[8] shipping was actively employed, and freight rates were highly remunerative. These conditions prevailed almost continuously until the Peace of Amiens in 1801. During this period the American merchant marine was protected by discriminating duties and prohibitions, which, beginning in 1789, increased in severity; and in addition it had the advantage of being the chief neutral carrier.

On the other hand, serious losses were suffered as a result of the measures against neutral shipping taken by the rival powers and of the weakness of the United States Navy, which was unable to protect merchant vessels from illegal attack. French continental and colonial ports were opened to American merchantmen in 1793, but in June of that year a British Order in Council ordered the detention of all neutral vessels loaded with food and provisions for French ports and the sale of their cargoes.[9] Under another

[5] Reeves, pt. III, chaps. i, ii; Sir Stafford H. Northcote, *A Short History of the Navigation Laws of England* (1849), pp. 20–27.

[6] Under 23 Geo. III, c. 29 (1783); 28 Geo. III, c. 6 (1788).

[7] A.R.C.N. (1914), p. 186.

[8] For a review of the general economic conditions of the time, see Smith and Cole, p. 15.

[9] *Documents Relating to France and Great Britain* (1793), American State

Order in Council in November, which established a blockade of the French West Indies, several hundred ships were captured and condemned.[10] The French navy also seized American vessels under one pretext or another, especially in 1796, 1797, and 1798, during which years the number carried into the ports of Spain alone was 134.[11] Spanish ships also seized and carried in fifty-five vessels. The naval war with France began in 1798, and lasted until 1800. The risks encountered by firms engaged in commerce and shipping were therefore formidable, although the profit margins were large.

Under these conditions the American merchant marine expanded rapidly between 1789 and the turn of the century. This growth was, however, less than is commonly believed because of the serious errors in the official statistics.[12] The registered tonnage increased from about 124,000 gross tons in 1789 to about 290,000 tons in 1792,[13] and to about 365,000 tons in 1793.[14] It was probably between 500,000 and 525,000 gross tons in 1800. The enrolled and licensed tonnage engaged in the coastwise trade also

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Papers, Foreign Relations, vol. I, no. 65, pp. 239–240. (Hereafter cited as A.S.P., F.R.)

[10] *Documents Relating to France and Great Britain* (1793), pp. 428–430; Hans Keiler, *American Shipping, Its History and Economic Conditions* (1913), p. 33.

[11] *Report on Spoliations by French and Spanish Vessels* (1802), House Doc., 7 Cong., 1 Sess., A.S.P., F.R., vol. II, no. 173, pp. 446–456.

[12] For a general statement see the testimony of the Hon. E. T. Chamberlain, Commissioner of Navigation, to the Merchant Marine Commission, Senate Report no. 2755, 58 Cong., 3 Sess., pp. 1762–1767. (This source is hereafter cited as R.M.M.C.) The errors are also carefully traced and discussed in Keiler, pp. 31–32, 34–37, 43–45, 51–52. In general the statements of the volume of American tonnage documented are extremely unreliable prior to 1821, when the general system of statistics was established. The figures given in the official statistics for the years 1789–1792 for registered tonnage were computed from the tonnage dues receipts and consequently are probably too high, for a vessel might arrive several times in a year. Direct returns were made from 1793 on, but in general the figures are too high owing to the failure of the district collectors to cancel the documents of many vessels which had been lost, captured, sold, or broken up. Numerous partial attempts at correction were made, so that the error cannot be considered as growing steadily. It is believed to be particularly large during the periods 1790–1792, 1797–1800, 1810–1817. An effort has been made to correct the figures in the statement above, but the result is at best a rough approximation.

[13] The official figure is 411,438 tons. A special report puts the fleet at 289,394 tons. See Alexander Hamilton, Secretary of the Treasury, *A Comparative View of Tonnage for the Years 1789, 1790, 1791, and 1792* (1794), A.S.P., C.N., vol. I, no. 17, p. 252.

[14] This is the first year in which district returns were made. The official figure is 367,734 tons.

increased from about 120,000 gross tons in 1793 to about 240,000 gross tons in 1800. The size of the total merchant marine, including fishing and whaling vessels, may be put at about 770,000 gross tons in the latter year.[15] The wars and the resulting demand for tonnage and high prices of goods thus had the effect of stimulating enormously the shipping and mercantile interests engaged in foreign trade, and also the coastwise operators, who acted as feeders and distributors.

With the resumption of war again in 1803 another period of active trade began, which lasted until the establishment of the Embargo of 1807. American shipping was severely harassed by foreign regulations and depredations as before, but its position as the chief neutral carrier, its natural competitive strength, and the strong protection accorded it by the American navigation laws produced a considerable although intermittent prosperity until 1811 except for the Embargo period. The British in 1804 blockaded the French and Dutch West Indies and the Continental channel ports, and by 1806 the latter blockade had been extended to Brest and the Elbe.[16] Napoleon, in turn, by the Berlin Decree, which declared a blockade of Great Britain, made all American vessels which touched at British ports subject to capture. Further confusion was created by the British Order in Council of 1807 which required neutral ships trading to France or her possessions to call at British ports and pay duties,[17] and by Napoleon's counter blow, the Milan Decree of 1807, which ordered the seizure of all vessels touching at British ports or searched by British warships.[18] To complicate matters further, the American government by the Embargo Act of December 22, 1807 [19] prohibited the de-

[15] The official figure for the registered fleet in foreign trade is 667,107 tons, and for the entire merchant marine, 972,492 tons. The Hon. Albert Gallatin, the Secretary of the Treasury, reported, however, in 1802 that: "there is every reason to believe that the total difference between the actual tonnage of every description and the tonnage returned in the statement as such was not less than 200,000 tons on the last day of the year 1800 — that is to say, instead of the 972,000 tons exhibited in the statement, the United States did not possess over 770,000 tons." See *Report on Tonnage for the Year 1800* (1802), A.S.P., C.N., vol. I, no. 61, p. 494.

[16] Keiler, pp. 39–40.

[17] *Documents Relating to Great Britain* (1808), A.S.P., F.R., vol. III, no. 210, pp. 29–31.

[18] *Documents Relating to Great Britain, France, and Spain* (1808), A.S.P., F.R., vol. III, no. 219, pp. 290–291.

[19] 2 U.S. Stat. 451 (1807).

parture of American ships in foreign trade, in consequence of which many owners kept their vessels abroad where many were seized under Napoleon's Bayonne Decree of 1808. The lifting of the Embargo in 1809, and its replacement by the Non-Intercourse Act,[20] revived foreign-trade shipping again, and this prosperity lasted until the second Embargo Act of April 24, 1812.

Shipping during the entire period from 1803 to 1812 was conducted under difficulties, but the industry nevertheless was fairly profitable on balance. Severe discriminating duties confronted shipowners on every hand, and the seizures for violation of regulations were extensive, the British having captured 917 vessels, the French 558, and the Neapolitans 47 up to July 1812.[21] Nevertheless, the documented tonnage, although idle at times, remained high. On the eve of the first Embargo Act the size of the foreign-trade fleet was about 840,000 gross tons,[22] but it fell to about 763,000 gross tons in 1811.[23] The former figure was relatively large, and was not surpassed until 1843. In the same year, the coasting fleet amounted to somewhat over 400,000 tons.[24] On the whole the period was a moderately prosperous one for the shipowners and builders. A surprising feature was the vigor exhibited by the shipping industry despite serious risks and losses and conditions which generally caused a lack of confidence. Those owners and merchants who escaped serious difficulties made large profits, however, out of the wide profit margins existing, much of which income was reinvested in the business. Many of the fortunes of the seacoast towns were built up at this time. American vessels comprised from 83 to 96 per cent of the gross tonnage entered from foreign ports during this period.[25] Thus closed an era of uneasy prosperity.

[20] 2 U.S. Stat. 528 (1809).

[21] *Documents Relating to Aggressions by the Belligerents* (1812), A.S.P., F.R., vol. III, no. 250, pp. 583–585.

[22] The official figure is 840,163 tons; this is believed by Keiler to be approximately correct. See Keiler, p. 43.

[23] In this year the official figures were corrected, the final return being 763,607 tons.

[24] The amount of error in the returns of enrolled and licensed tonnage is unknown.

[25] R.M.M.C., III, 1764. The statistics of tonnage entered and cleared are believed to be reasonably accurate.

3

After 1815 the opportunities for large profit in the foreign carrying trades and in trading were considerably diminished as a result of the cessation of war, the reappearance of a large amount of foreign-flag tonnage on the primary world trade routes, the lessened demand for American exports, and the increased order and rationalization in trade. The highly forced and irrational international division of labor which had existed during the wars was supplanted by a more normal situation in which there was less demand for tonnage for the foreign carrying trades. It was primarily this decline in total demand, rather than any substantial weakening of the competitive position of American vessels in the direct foreign trades, which caused the decline in the American registered fleet at this time. There is, therefore, little ground for believing that the reciprocity policy was primarily responsible for this decline.[26] After years of wartime expansion some contraction in profit margins and activity was inevitable.

American trade and shipping suffered severely during the War of 1812 as a result of British naval activity, and the reëstablishment of well-founded prosperity required much time. Some 1407 merchant vessels were taken in war, but this loss was partly offset by the capture of about 2300 enemy vessels, only some of which, however, eventually reached American ports.[27] Entries of American vessels from foreign ports, which had totalled 921,750 gross tons in 1811, fell off to 58,756 tons in 1814, but recovered to 694,754 tons in 1815.[28] The fleet employed in foreign trade also failed to regain its former size after the reëstablishment of peace. The registered tonnage documented in 1816 was fairly large, being 800,759 tons,[29] but the years 1815–1817 were boom years in shipping because of the poor harvests abroad, the revival of commerce, and restocking of markets. In 1818 a severe reaction in business set in, however, which carried the registered tonnage down to a low of 589,944 tons at the end of the year.[30] Subse-

[26] For an emphatic statement see Chamberlain's testimony, R.M.M.C., III, 1761–1762. For a contrary view see W. W. Bates, *American Marine* (1893), chap. vii.

[27] Henry Hall, *American Navigation* (1880), p. 46.

[28] R.M.M.C., III, 1765.

[29] Corrected figures given by Joseph Nourse, Registrar, *Report on Commercial Intercourse with Foreign Nations* (1822), House Doc., 17 Cong., 1 Sess.; reprinted in A.S.P., C.N., vol. II, no. 256, p. 648; A.R.C.N. (1914), p. 186.

[30] A.R.C.N. (1914), p. 186. The tonnage statistics were carefully revised in this year and all lost vessels were removed.

quently there was a slow painful recovery to 757,998 tons in 1828, but the war levels were not surpassed. The American tonnage entered from foreign ports moved roughly in sympathy. Entries declined to 755,101 gross tons in 1818 but subsequently rose to a peak of 942,206 gross tons in 1826,[31] which figure was slightly in excess of that of 1811. On the whole, therefore, American shipping employed in the foreign carrying trades made little progress during this period.

In contrast, the coastwise fleet showed a steady growth from 475,666 gross tons in 1815 to 842,906 gross tons in 1828, thus reflecting the rise of manufacturing and of a more extended division of labor within the United States. In 1820 this fleet exceeded that employed in foreign trade for the first time. The acquisition of Louisiana with its important port of New Orleans in 1803 and Florida in 1819 did much to augment this branch of the shipping industry. With the development of the South and West an ever-increasing volume of goods moved down the Mississippi, a considerable part of which went to the northeastern ports in coastwise vessels. The change in the importance of the two branches of the carrying trade was further shown in the documents taken out by new vessels. In 1815 the registered tonnage built had been 106,079 tons, compared with an enrolled tonnage of 48,545 tons, but ten years later, the amounts were nearly equal, being 61,492, and 53,102 tons respectively. The shipping in the coastwise trade was protected by strong, discriminating port dues after 1789 [32] and by a complete navigation monopoly after 1817.[33] Hence the development of this branch of the industry was relatively steady, and was comparatively unaffected by the fluctuating forces which affected the shipping employed in foreign trade. The dominating factors governing the growth of the coastwise fleet were the general business conditions of the country, the development of agriculture and industry, and the rise of the railroads. The two branches of the shipping industry therefore followed separate paths, but it should be noted that owners freely shifted vessels of all types from one branch to the other.

Another branch of the shipping business to expand notably between 1815 and 1830 was the whaling industry, which was becom-

[31] Chamberlain's figures, R.M.M.C., III, 1765; A.R.C.N. (1914), p. 150.
[32] 1 U.S. Stat. 27 (1789).
[33] 3 U.S. Stat. 35 (1817).

ing extremely profitable owing to the exploitation of the new Pacific whaling grounds, and the low cost of the American oak whaleships which were used. Vessels were diverted from the merchant service in considerable numbers at times, and many new whaleships were built during this period. The whaling fleet, which had apparently been insignificant in size before 1812, increased to 32,386 gross tons in 1819 and 57,284 tons in 1829,[34] at which time its size was about a tenth of that of the registered merchant fleet.

4

The American shipping industry in the foreign trade did not develop freely and evenly during this period. Instead the rise took place primarily on a number of direct and triangular routes on which the owners were able to secure a foothold by reason of their competitive advantage, their personal business contacts, or the peculiarities of the navigation systems. On some of these routes, such for instance as that to China, they were able to secure nearly all of the business, whereas on others they were but occasional traders. The seas of the world were extremely broad at this time. Trading vessels were even able to keep the location of lucrative markets secret. Information regarding the state of markets for goods and tonnage circulated slowly. Navigation systems also tended to force vessels into the direct carrying trades radiating from national ports. Furthermore, each nation and seaport tended to develop spheres of influence and voyage patterns peculiar to itself. Hence on many routes international competition was not an important phenomenon.

Among the carrying trades which contributed to the rise of the American merchant marine were those to the eastern seas, which had been rarely visited by colonial vessels because of the monopoly enjoyed by the East India Company. Direct navigation to Canton was opened in 1784 by the *Empress of China*, 360 tons, a "commodious and elegant ship" which was owned in New York,[35] and the *Grand Turk I*, 300 tons, which was one of the substantial vessels which Thomas Barnstow of Hanover had built for the growing armada of Salem's tycoon, E. H. Derby.[36] Other East

[34] A.R.C.N. (1914), p. 186.
[35] Cutler, p. 16.
[36] Peabody, chap. i; F. R. Dulles, *The Old China Trade* (1930), chap. i.

Indiamen soon followed this route, among them being the *Hope*, which sailed from New York for Canton in 1786, the *United States*, which sailed from Philadelphia to India and China in 1784,[37] and the *Chesapeake*, which sailed from Baltimore to India in 1786.[38] Numerous venturesome voyages were also made during the 'nineties to the Cape of Good Hope, Mauritius, Ceylon, Bombay, and India generally for cloths and other Indian goods, to Sumatra and Malaya for spices and pepper, to Arabia for coffee, and to the Philippines for sugar, hemp, and spices.[39] American ships began arriving at ports formerly without direct communication with North America — the ship *Astrea I* at Pegu, Burma, in 1793, the schooner *Rajah* on the Sumatran coast in 1795, the ship *Recovery* at Mocha in 1798, and the ship *Astrea II* at Manila in 1798. Thus by 1800 a number of valuable long-voyage carrying trades had been created.

These trades were developed by pioneering owners whose vessels were primarily laden with owners' cargoes. The returns on the earliest of these long, risky trading voyages were very large and made the fortunes of many such firms. Salem, in particular, was a center of this business, for her shipmasters first accumulated a substantial volume of information regarding eastern seas and markets. The owners engaged in this trade soon became foremost in importance among the shipping interests in many of the ports. American firms were able to secure control of this trade because the United States navigation acts effectively penalized operators of foreign ships in such direct trades, and the shipment by the indirect route by way of London or Amsterdam was too costly because of the East India Company's monopoly, the expense of navigation, and the discriminatory American duties. This branch of the carrying trade was therefore effectively exploited by American firms operating vessels of all types. Particularly prominent were a dozen or so rising East India merchants, among whom may be listed E. H. Derby, William Gray, Russell & Company, Bryant & Sturgis, and N. L. & G. Griswold. These firms were typical of large business enterprise in the era of mercantile capitalism in the

[37] "Notes on the Log and Journal of the Ship United States on a Voyage to China in 1784," *Pennsylvania Magazine of History and Biography*, LV (1931), 226.

[38] Kirkland, p. 225.

[39] S. E. Morison, *Maritime History of Massachusetts*, pp. 79–95; R. D. Paine, *Ships and Sailors of Old Salem*, 3rd ed. (1924), p. 346; Kirkland, p. 225.

United States. Large profits often resulted from an absence of keen competition in far-away ports and from careful forecasting and favorable conjunctures. Such firms built the large, heavily built, well furnished East Indiamen which were the pride of many seaports. Many of these large enterprises were able to establish business connections in the Orient which, in conjunction with those at home, gave them a great advantage in the trade. Russell & Company, in particular, had a close relationship with Houqua and other Chinese merchants. There was little opportunity for general carriers to secure business. The majority of the vessels going to the Far East at this time were, therefore, private traders carrying mainly owners' goods. Some of these merchants even carried East India goods directly to Europe, unloading at Amsterdam, Hamburg, and other ports. Others shipped them to England and the Continent indirectly by way of American ports. United States maritime activity in the Eastern Seas was thus based on private trading rather than on general carrying.

Another new trade was that to the Northwest Coast of America by way of Cape Horn. This route was first pioneered by the Hanover-built ship *Columbia*, 212 tons, Captain Gray, which sailed from Boston in 1787, and arrived home in 1790 by way of Canton after logging some 50,000 miles. Soon other ships were sailing to the Pacific, some of which touched at Japan. Among the first vessels touching here were the sloop *Lady Washington* in 1791 and the ships *Eliza*, *Franklin*, *Massachusetts* and *Margaret* in 1797, 1799, 1800, and 1801, respectively.[40] Others explored the Pacific Islands, among the first of them being the ship *Lydia*, which touched at Guam in 1801. Furs soon came to provide the chief cargo westbound across the Pacific. These furs were exchanged at very profitable rates for assorted Oriental goods in the ports of China. The owners of all of these vessels achieved their success by pioneering new trades in which there was little foreign competition.

The total amount of tonnage employed in both the East India and Northwest Coast trades must have been substantial for that time. For example, in 1821, a poor year, 43,201 tons of American shipping, or 5 per cent of the total tonnage, cleared for the Northwest Coast, the British, Dutch, Danish, and French East Indies, Bourbon, Mauritius, the Cape of Good Hope, China, Manila, Asia

[40] Paine, p. 218.

generally, and the South Seas. The clearances for the South Seas, 16,809 tons, probably consisted mainly of whalers. Assuming that the average size of the remaining vessels was 200 tons and that an average round voyage required two years, it appears that around 260 vessels were engaged in these carrying trades.

The rising North Atlantic passenger lines of the United States were businesses of a very different type. The success of the American packet ships, which were common carriers, was based primarily on low costs, excellent construction, and hard sailing. Rationalization of the service and efficiency in the conduct of the business were required, rather than mercantile ability.

For many years the important North Atlantic carrying trade had been lifted in an assortment of irregularly-sailing freighters, and no serious effort had been made to institute the fast regular service for express cargo, mail, and passengers which even then was possible in sailing vessels. Prior to 1818 the passenger service was conducted by small, unspecialized, private trading vessels which sailed more or less regularly, usually making two trips a year, and by the British Post Office packets, which sailed monthly.[41] The private traders, which were mainly American, had probably been adequate for the small-scale commerce of the eighteenth century, but by 1815 economic conditions warranted an effort to provide better European communications. Conditions were also then more favorable than formerly because of the passing of the Navigation Act of 1815, which provided for the reciprocal removal of discriminating duties on imports carried in ships of the country of origin,[42] and the conclusion of a reciprocity treaty with Britain.[43] These measures secured a free highway from New York and Boston to Liverpool and London and provided for fair competition between British and American vessels operating on this route.

The year 1818 consequently saw established at New York the Black Ball Line, the first organization to create and maintain a scheduled North Atlantic service. Several ill-fated efforts to run more or less regular ships had been made before, among them

[41] Cutler, p. 55; H. M. Stationery Office, *The Post Office, An Historical Summary* (1911), pp. 46–50.
[42] 3 U.S. Stat. 224 (March 3, 1815).
[43] *Treaties and Conventions of the United States, 1776–1909* (Malloy, 1910), 2 vols., Senate Doc. no. 357, 61 Cong., 1 Sess., I, 624–627.

being a Boston–Liverpool line, which had begun with three vessels in 1805, but had soon ceased running, and the subsidized French line from New York to Lorient, in which small, fast, coppered packets of about 300 tons were operated in a monthly service from 1783 to 1792.[44] The Black Ball Line dispatched the ship *James Munroe*, 424 tons, from New York January 5, 1818, and the ship *Courier*, 381 tons, from Liverpool on January 4, 1819.[45] This particular service was thereafter to be a distinctive feature of the American shipping industry until long after the Civil War. The owners of this interesting enterprise, Jeremiah and Francis Thompson, Benjamin Marshall, Isaac Wright, and William Wright, who had been textile importers,[46] attracted such patronage by virtue of their regular schedules and hard-driving passages [47] that they were soon able to add to the original fleet of four small ships larger vessels more adapted to the packet trade.

After the depression of 1819 numerous competing lines also arose and added many splendid ships to the American fleet. The Red Star Line, operated by Byrnes, Trimble & Company, and the Swallowtail Line, run by Fish & Grinnell, entered the New York–Liverpool service in 1822. To meet this competition, the Black Ball Line began to double its fleet. By the fall of 1822, New York had four liner sailings a month to Liverpool: the Black Ball on the first; the Swallowtail on the eighth; the Black Ball on the sixteenth; and the Red Star on the twenty-fourth.[48] American liner services were also soon established to other European ports. To London from New York went the "Black X" Line, managed by John Griswold, irregularly in 1822, and regularly by 1824. Associated with this line, except for the years 1827–1833, was the London Swallowtail Line of Fish, Grinnell & Company.[49] From New York to Havre, following the conclusion of a reciprocal navigation treaty with France in 1822,[50] also

[44] F. B. C. Bradlee, "The Dreadnought of Newburyport and some Account of the Old Trans-Atlantic Packet Ships," E.I.H.C., LVI (1920), 11–12; Saugstad Report, p. 98.

[45] Albion, *Square-Riggers on Schedule*, pp. 20–22.

[46] Albion, *Square-Riggers on Shedule*, p. 25.

[47] Albion, *Square-Riggers on Schedule*, p. 29.

[48] Albion, *Square-Riggers on Schedule*, p. 31.

[49] Albion, *Square-Riggers on Schedule*, p. 34.

[50] U. S. Treaties (Malloy, 1910), pp. 521–523. This action followed a lively battle with discriminating dues, culminating in the Act of 1820, which placed a prohibitive tax of $18 per gross ton on French ships. See 3 U.S. Stat. 605.

went two lines, the First Havre Line of Francis Depau, established in 1822, and the Second Line, established in 1823.[51] The New York shipbuilders who constructed the New York packets were closely identified with many of these New York lines. Boston owners also organized a Liverpool line in 1823 with four little ships built by Thatcher Magoun at Medford and named after jewels. Both this line and its successor, established in 1827, failed, primarily because of lack of adequate outward cargoes. A line was also established at Philadelphia in 1822 by Thomas Cope. By 1830 the principal American ports had excellent liner communication with Europe by means of American-flag vessels.

The North Atlantic lines introduced a new form of organization into the shipping industry. Significant economies of large-scale enterprise were for the first time achieved by common carriers on a major route. The pecuniary value of a differentiated service supported by advertising also first became apparent. Although the size of the packet firms was never great, judged by later standards, primarily because of a lack of a large volume of general cargo and passenger traffic, the value of organization, some rationalization, and an established position in the trade were clearly shown. For the first time the monopolistic competition and the consequent control of the market, which were later to characterize the shipping industry, appeared, although on a minor scale. The lines, for the most part, consisted of from four to ten vessels, which ranged in size from 400 to 600 tons, each of which made about three round voyages a year. The cost of these vessels, which were usually of the highest class, was between $50 and $70 per gross ton. The prestige, financial stability, and strong competitive position of the American packet lines enabled them to dominate completely the Atlantic packet service without the aid of any subsidy. Their success and dominant position were soon to become a matter of deep concern to the British government. Well built at relatively low cost, driven at full speed by energetic and capable shipmasters,[52] and carefully organized in lines, these vessels secured the cream of the westbound cargoes of British manufactures, of the scanty eastbound cargoes, and of the passenger business.

The remaining vessels engaged in the foreign trade were em-

[51] Albion, *Square-Riggers on Schedule*, p. 33.
[52] A. H. Clark, pp. 39–47.

ployed on a variety of routes on many of which, because of the interests of the merchants or the peculiarities of navigation systems, shipping operations were especially profitable. One of these trades was the cotton triangle. Because of the absence of voluminous cargoes eastbound from North Atlantic ports, American vessels commonly sailed to southern ports, chiefly Charleston, Savannah, Mobile, and New Orleans, to load cotton (which was the principal cargo), naval stores, and timber for Europe. Homeward bound to New York, Boston, Portland or other northeastern seaports, they carried British and Continental manufactures, coal, and other raw materials. American cotton began to arrive at Liverpool in 1785,[53] but total exports amounted to but 379 bales in 1790. By 1815, however, exports amounted to 163,894 bales, or enough to load about forty vessels, and by 1830, they had risen to 553,960 bales.[54] Cotton had become by this time a leading American export, counting, for instance, for $20,000,000 of the $54,000,000 worth of goods, excluding specie, exported in 1821. Small ships and brigs consequently began going south in large numbers. Bath, later to be a leading cotton-ship port, sent her first vessel to New Orleans, the brig *Androscoggin*, in 1802.[55] Over half of the cotton was shipped direct to Europe, and the rest was brought to northern ports for transshipment.[56] As the years passed the cotton trade came to be more and more the principal sustaining influence in the shipping business of the United States.

American vessels had a special advantage in this business because those of foreign registry were charged burdensome port dues on the coastwise leg until 1817, and then were entirely barred from carrying cargo on it. Thus they found difficulty in completing a profitable voyage.[57] British vessels could go to the cotton ports by way of Canada, where timber was loaded for the West Indies, or directly by way of the British West Indies, but neither of these routes was satisfactory from the standpoint of earnings. French, Dutch, and Scandinavian vessels were even less fortunate in securing cargoes carrying them toward the cotton ports. British cotton ships had the advantage, however, of being

[53] Albion, *The Rise of New York Port*, p. 98.
[54] J. A. B. Scherer, *Cotton as a World Power* (1916), p. 420.
[55] P. McC. Reed, p. 151.
[56] Albion, *The Rise of New York Port*, p. 101.
[57] *Report of the* [British] *Select Committee on Merchant Shipping* (1844), Parliamentary Papers, 1844, VIII, 57.

able to engage in the Canadian transatlantic timber trade in the off seasons.[58] The volume of freight moved directly to the cotton ports was light. Hence foreign vessels had difficulty in securing profitable outbound business. In addition, the intricate commercial ties between northern shipping firms and southern merchants soon gave American ships a marked preference.[59] Many shipping houses consigned the cotton and were in a position to favor their own vessels. Hence in 1833 Joshua Bates estimated that three fourths of the cotton being imported into Britain came in American vessels.[60] English owners complained bitterly of the resulting unprofitable level of freight rates.[61] Thus the American shipping industry was able to increase its general advantage in a portion of the North Atlantic carrying trade because of the triangular voyages and of the restrictions on the operation of foreign vessels in the coastwise trade embodied in American navigation policy.

American shipping was also active in other European carrying trades. In the Mediterranean trades, especially those to southern France and Italy, many small vessels found profitable employment, largely because of their low costs of operation and construction. France, the chief rival in this business, had one of the highest price levels for vessels in Europe because of the policy of autarchy in respect to shipbuilding and of the high cost of timber. Being geographically not so well placed as England and without extensive American possessions, she was also unable effectively to protect her shipping in the North Atlantic trade by means of navigation monopolies. In the Baltic carrying trades, however, competition from the low-cost ships of that area made American shipping operations relatively unprofitable, although American-flag ships frequently went there. This was, in fact, the sole important maritime region with which American vessels traded which could build vessels at equal or lower cost.

Finally, American shipping was in a strong position in the South American and West Indian trades for a number of reasons.

[58] *Report of the* [British] *Select Committee on Merchant Shipping* (1844), p. 58.

[59] *Report of the* [British] *Select Committee on Merchant Shipping* (1844), p. 57.

[60] Statement of Joshua Bates of the firm of Baring Brothers, *Report of the* [British] *Select Committee on Manufactures, Commerce, and Shipping* (1833), p. 53.

[61] Joshua Bates, *Report of the* [British] *Select Committee on Manufactures, Commerce, and Shipping* (1833), p. 49.

Basically South America and the West Indies possessed neither the capital, nor the entrepreneurial talent, nor the skilled labor necessary for the development of the maritime industries, for their primary economic interests were in agriculture. Consequently the opening of Brazilian ports in 1808 and the Latin-American revolutions, which began in 1810, made the carrying trade to South America available to United States vessels.[62] These craft met almost no competition, for European craft were excluded, for the most part, by the American navigation laws. In contrast, the important carrying trade to the West Indies was regulated by the complicated navigation policies of France, England, Spain, and the United States. Except for periods of discrimination, however, American vessels tended to dominate it. The ownership of outward cargoes of fish and lumber was an important factor in this connection. As in colonial times, the fishery was an important mainstay of the trade. Many fishing schooners sailed south with cargoes of dried cod in the winter season. The multitudinous carrying trades of these areas provided a fertile field for American owners, especially those having small agile vessels.

Except during war time American vessels engaged in but little general cargo business between foreign ports, mainly because of the restrictions imposed by foreign states on such operations. During the wars, however, many of these were relaxed, with the result that the United States became the great neutral carrier of Europe. To a considerable degree this development was due to the investment of European capital in American vessels in an effort to prevent captures. It was at this time also that trading operations of the reëxport type were most profitable. Merchants and shipowners assembled cargoes from many places, some as far away as the East Indies, in their home ports, and then reexported them to Europe. American reëxports amounted to $6,500,000 as early as 1794 as a result of the European wars. Imports from Europe were likewise redistributed throughout the world. After 1815, this type of activity tended to diminish as commerce became more direct. A certain amount continued, however, because of the low navigating costs of American ships, the enterprise, commercial connections, and trade information of their owners and masters, and the peculiarities of foreign navigation systems. However, the tramping, trading, and reëxport busi-

[62] Kirkland, pp. 224–225.

nesses, although among the most romantic features of early American maritime history, soon became an anachronism in a more highly organized and efficient world economy.

5

The organization of the shipping industry was an important factor in American maritime development at this time. The ships of the period may be divided according to function into two categories: the general cargo carriers, which carried shippers' goods for the freight, and the trading ships, which were owned by merchants and carried primarily owners' cargoes. The first category comprised the scheduled packets, some of the regular traders, which voyaged between fixed ports, although not on schedule, and some of the tramps. The second category consisted of both regular traders and tramps, although occasionally, as in the case of the East India Company vessels, trading ships sailed on schedule. These private trading vessels were the predecessors of the industrial carriers of the present day. No clear line can be drawn between the general carriers and the trading vessels, however, for most of the traders usually carried some cargo for the freight money, and most of the general carriers normally had some owners' goods aboard. On the whole, it appears probable that the trading function predominated in American shipping until about 1830.

This fact is of great importance, for when trading and shipping were combined in one firm the enterprise succeeded or failed on the basis of its performance in both functions. It is therefore impossible to analyze the shipping industry independently. Furthermore, competition between ships became much less severe when th ownership was merely incidental to other operations, as was frequently the case. Owners of this type may be styled maritime merchants, for they specialized in the movement of goods between markets by sea. For this business special knowledge of commodities, near and distant markets, demand and supply, and shipping activity were of the utmost importance, for the merchant's profit depended on the margin between selling and buying prices. This margin in turn depended on the ability to forecast markets months and even years ahead. There were two methods of training men for this business: a career as a shipmaster in the foreign trade, or a period at college followed by an apprenticeship in a mer-

chant's counting house.[63] Those maritime merchants who became wealthy lived dignified, sedentary lives while managing their fleets from their counting houses. The ownership of vessels staffed by his own masters and supercargoes, who could act independently and quickly abroad, try various markets, make advantageous contacts, and promptly relay information, was of the utmost importance to such an owner. For merchants trading in the Orient it was almost a necessity; for there were no established commercial contacts, common carriers were not always available, and mails were slow. Furthermore, it was not always possible for a merchant to rely on other owners or masters to secure as good sales for the goods which he entrusted to their care as for their own, to make wise purchases abroad, and to relay important information to him. Smaller-scale merchants commonly found it necessary to sail aboard or command their own craft. Although less likely to secure as much information as their larger rivals, they could thus personally supervise purchases and sales and the conduct of the voyage. Thus at this time an importing and exporting business could be more effectively conducted if vessels were owned by the firm. It follows that the merchant marine received considerable support from this connection.

Some of these merchants owned large fleets and engaged in shipping and trading generally. Such men sent large vessels to the West Indies, the Eastern Seas, and Europe, and also operated smaller craft coastwise to collect and distribute cargoes. Among the most noted of these were the Salem houses of E. H. Derby,[64] William Gray,[65] Joseph Peabody, and William Lee,[66] and the New York firms of N. L. & G. Griswold, and Grinnell, Minturn & Company. It is estimated that William Gray alone took possession between 1785 and 1825 of some 160 vessels, of which some fifty were full-rigged ships. In one year as many as ten new vessels passed into his fleet, which was built in yards as far apart as Portland and New York. The diversity of his operations is shown by the fact that in 1815 he secured the new ships *Union*, *Saco*, and *Elizabeth*, the brigs *Ludlow*, *Romp*, and *Lawrence*,

[63] K. W. Porter, *The Jacksons and the Lees, Two Generations of Massachusetts Merchants*, 2 vols. (1937), I, 7–9; H. Corning, "Abstract of an Autobiography of David Augustus Neal," *Bulletin of the Business Historical Society*, vol. XII (1938).

[64] Paine, pp. 141–164.

[65] Edward Gray, *William Gray of Salem, Merchant* (1914).

[66] K. W. Porter, *The Jacksons and the Lees*, *passim*.

and the schooners *Chance* and *Bee*, besides several older ships.[67] Other firms specialized more or less in one branch of trade, and sometimes operated fleets of regular traders. Among these may be mentioned the China trade houses of Russell & Company, Bryant and Sturgis, and J. J. Astor.[68] Several score were entrenched in each of the important trades to Liverpool, London, Havre, and other European ports. Smaller houses trading in fish, lumber, foodstuffs, and West India goods were established in almost every seaport, great or small, and sent one or more vessels every year to the West Indies or the Mediterranean, or coastwise to the southern states. There was thus great variety among the shipping firms. Each type fulfilled a particular function.

American maritime trade indeed preserved in 1830 much of the medieval character which it had in the colonial era. Many firms still performed the full-line functions of contact, selection, transportation, storage, wholesaling, and retailing characteristic of mercantile business of that time.[69] Private trading ships had then been common. For example, at New York in 1764, Gregg, Cunningham & Company owned thirteen, W. & S. Franklin Co., six, and Walton Brothers, four.[70] The merchants, who in consequence of the imperfection of the market system often made large profits, still stood among the foremost groups in American economic life. Extensive family relationships, which frequently linked many foreign and domestic ports, often enabled each house to control numerous lines of commerce. Each house also usually had trusted agencies in other centers. The necessary capital was commonly raised if possible within the family. The partnership was, however, the most common type of organization, both in trade and in shipping. The ownership of vessels was still commonly divided into halves, thirds, and fourths, although occasionally as many as thirty or forty names appeared on the registers. Success depended on the markets at home and abroad and on the ability of the merchant to dispose of his goods readily in the home port or elsewhere.[71] The operations of these maritime mer-

[67] Gray, Appendix, pp. 107–108.
[68] K. W. Porter, *John Jacob Astor, Business Man*, 2 vols. (1931), *passim.*
[69] Harrington, p. 66.
[70] Harrington, p. 52.
[71] *Memorial of the Merchants of Salem* (1820), House Doc. no. 59, 16 Cong., 2 Sess., pp. 8–10.

chants were greatly benefited by the existence of free trade and of considerable freedom of navigation. Consequently they vigorously opposed the rise of protectionism. Because of duties, they said, "merchant vessels must remain unemployed to rot by the wharves." [72] Maritime enterprise had thus not greatly changed since the eighteenth century.

With the rise of more stable and larger-scale trade after 1830, however, the functions of transportation, importing and exporting, and retailing became separate. With this change the American shipping industry lost the support of the mercantile interests. For the time being, however, the trading and transportation functions were closely entwined.

6

In contrast to the situation today, the economic conditions of the early American period produced a widely dispersed shipping industry. Each bay and stream, except in the South where streams were few and shallow, became a commercial hub through which the foreign and domestic commerce of its hinterland passed, and in which the shipping essential for this commerce was usually owned. The population was still localized primarily along the seaboard, and possessed few adequate means of transportation other than by sailing vessel. No deep grooves of commerce, such as later were to concentrate the population and the shipping industry in a few great ports, had yet appeared. Markets were small, and both the foreign and domestic commerce of a port was normally conducted directly by its merchants without reference to any larger market. Consequently even the smallest streams possessed customs houses, wharves, warehouses, and fleets of deep-sea and coasting craft.

Hence except where the supply price of shipping enterprise was high or capital was unenterprising, the volume of tonnage owned in a port was roughly proportional to the commerce of that port. To a large extent these vessels were also employed in trade connected with it. The capital for the shipping industry of each center was mainly supplied by local residents, for no national market for vessel shares existed. In any case shareholders preferred to know personally those who were responsible for the

[72] *Memorial of the Merchants of Bath* (1820), House Doc. no. 20, 16 Cong., 2 Sess., p. 4.

enterprise and if possible to take part in managing it. In addition to the professional shipowners, these investments in ship shares were commonly made by shipmasters, builders, riggers, merchants, ship chandlers, and others acquainted with maritime affairs. Frequently vessels were also officered and manned in the home port. The combination of trade and shipping in one firm was another powerful factor making for localism in many ports. Indeed, it was sometimes difficult for common carriers to secure adequate cargoes for this reason. American shipping enterprise was thus to a considerable extent based on local resources of labor and capital and on local commerce, and the centers of its administration were to be found dispersed in hundreds of home ports.

To some degree, however, the maritime enterprise of certain ports overflowed into others. This was conspicuously true in the ports of the South, whose carrying trades were completely dominated by northern vessels. This was especially true of its direct transatlantic trade, that of the cotton triangle, and its long-voyage coasting trade. This situation was largely caused by the fact that the rapid expansion of agriculture in the South absorbed nearly all of the available capital and labor, with the result that it was impossible to buy and operate large vessels on any substantial scale with local resources. Furthermore, the capital and entrepreneurial talent of the northern shipping industry showed little tendency to migrate to the South. Consequently, Charleston, which had been a center of transatlantic shipping in 1815, when it owned 15,619 registered and 10,578 enrolled tons, had but 3,015 and 3,596 tons, respectively, in 1829, a decrease of 75 per cent. The other ports showed a comparable lack of progress. Northern vessels were handled in these ports by commission merchants or by resident partners, most of which were Northerners. Incidentally, in many cases the latter were able to give American vessels a preference over foreign ones.[73] The South failed, therefore, to develop a shipping industry commensurate with its volume of traffic.

The shipping industry was thus chiefly located north of the Virginia Capes. The bulk of it was centered between the Hudson and Eastport. Between these places there were thirty-five maritime centers served by customs houses, in which, in 1815, 874,575

[73] *Report of the* [British] *Select Committee on Merchant Shipping* (1844), p. 57.

tons, or 64 per cent of the total fleet, was documented. The primary large shipping centers were New York, Boston, Philadelphia, and Baltimore in the order named, each of which was an important trade gateway, a fact which made the location of the management of tonnage in these ports desirable. In 1815 the total documented fleets of these ports amounted to 278,869 tons, 137,009 tons, 99,310 tons, and 107,137 tons, respectively, out of a total American fleet of 1,368,128 gross tons.[74] With the rise of the West and the decline of the trading business, New York's proportion slowly increased while those of Philadelphia and Baltimore, in particular, declined; the figures for 1825 for the four ports are 304,484 tons, 152,869 tons, 73,808 tons, and 92,050 tons, respectively, and for 1834, 359,222, 212,536, 83,521, and 59,870 tons, respectively. Boston, however, was a close rival of New York in foreign-trade shipping. As late as 1830 the tonnage on permanent register there, 95,936 tons, exceeded that of New York by 4000 tons. Much of New York's tonnage consisted of steamboats, canal boats, schooners, and sloops for the river and sound carrying trades, as is shown by the fact that in 1830 there were 142,829 tons permanently enrolled and licensed, compared with 91,769 tons on permanent register. The minor shipping centers collectively were not insignificant. In 1815 there were forty customs houses where the permanently registered fleet exceeded 1000 tons.[75] Bath, Portland, Portsmouth, Newburyport, Salem, Plymouth, New Bedford, Middletown, and Norfolk all owned substantial foreign-trade fleets. Whaling-ship control was concentrated at New Bedford, Nantucket, and New London, and the codfishing business at Gloucester, Provincetown, Boston, and Newburyport.

The pattern soon began to change, however, as the American economy developed. The smaller ports failed to grow and as a result a number of their shipping firms established their administrative offices in Boston and New York. Many of these, however, still retained their former connections. Furthermore, vessels bear-

[74] R.C.N.T., 1815; A.S.P., C.N., vol. II, no. 202. These figures probably slightly overstate the tonnage in each case because of incomplete cancellations.

[75] It is important to distinguish between the permanent and temporary registers. The latter were issued to vessels sailing in the foreign trade at any customs house except that of the home port, and were not cancelled until the ship reached the latter, which might take some years. The primary conditions giving rise to such registers were construction and change of ownership or master.

ing the names of such eastern ports as Portsmouth, Brunswick, Bath, Thomaston, Camden, Belfast, and Bangor on their sterns began to appear frequently in the carrying trades of the large cities, and especially in those of New York and Boston. This change was due to the fact that the costs of entrepreneurial talent, labor, and capital were on the whole slightly less in eastern New England than elsewhere. The result was that this region became the primary shipping center of the nation. Averaging the figures for 1829 and 1830, we find that, of the ships and barks, Massachusetts owned 358, Maine 52, and New Hampshire 26; whereas New York owned but 239, Pennsylvania 38, Maryland 40, Rhode Island 39, and Connecticut 12.[76] Of the brigs and brigantines, Massachusetts had 592, Maine 229, and New Hampshire 18, against 242 for New York, 167 for Pennsylvania, 51 for Maryland, 69 for Rhode Island, and 39 for Connecticut. The supremacy of the eastern ports in the ownership of small coastwise shipping was also already beginning to appear. It may be concluded, therefore, that in 1830 the backbone of American maritime enterprise consisted of hundreds of large and small firms located in the cities, towns, and coastal villages of New England, especially the section north of Cape Cod, and that many of these vessels were finding increasingly profitable employment in the charter business of the large American cities.

The large seaports were also unable to supply fully their needs for new vessels at this time, and consequently imported them in considerable numbers from smaller ports and rural areas where there was a surplus output. Hence in Boston and New York there were substantial vessel markets for which shipbuilders in the outports constructed, partly on speculation and partly on order. Vessels already completed were usually sent coastwise, either empty under a carpenter's certificate or loaded under an enrollment, consigned to an agent for sale. Owners, on the other hand, sometimes visited shipbuilding centers and purchased vessels on the stocks. A wide difference in the ratio between tonnage built and tonnage owned thus came to exist. In 1833, for example, the ratios for New York, Boston, and Philadelphia were 9, 7, and 5 per cent, respectively, whereas in Bath, Waldoboro, and Machias they were 26, 31, and 33 per cent, respectively.[77] Some towns,

[76] R.C.N.T., 1829, 1830.
[77] R.C.N.T., 1833.

such as Portsmouth, which had a ratio of 11 per cent, were practically self-contained.[78] In Boston, however, of the new tonnage documented in 1815, 1820, and 1824, but 38, 33, and 36 per cent, respectively, were built in the port.[79] Most of the craft built in this port were ships and barks, the proportions of these being 56, 42, and 48 per cent, respectively, thus showing that the owners preferred local builders for the higher grades of vessels. Coasting and other low-grade craft were almost entirely built in the outports. Boston owners generally purchased vessels from builders east of Cape Cod, the most frequently patronized regions being southern Maine, the Merrimack, Penobscot Bay, the Kennebec, and Plymouth.[80] A similar situation existed at New York, where the owners turned to the Connecticut shore for vessels. Thus as early as 1815 town self-sufficiency had already begun to break down so far as the supply of ships was concerned.

7

The vigor of the merchant marine was due in part to the fact that during the period from 1789 to 1830 the United States government pursued a strong policy which was well calculated to develop American commerce and shipping. The public interest without a doubt lay at this time in the promotion of free trade and free navigation, and in the strong support of those export industries in which the United States possessed a comparative advantage. The country then was primarily a producer of raw materials and foodstuffs, which it was necessary to exchange for the manufactured consumer and capital goods of the world, especially those of Great Britain. Cheap transportation, frequent service, and flexibility in the conduct of trade were therefore of great importance if a maximum advantage from this division of labor was to be secured. That it be secured was essential, for

[78] See Edmonds, *Portsmouth City Directory* (1839).

[79] Figures compiled from the Boston Registers and Enrollments. They are as follows:

SOURCES OF NEW VESSELS DOCUMENTED AT BOSTON 1815, 1820, 1824

	1815		*1820*		*1824*	
Register	*Boston*	*Outports*	*Boston*	*Outports*	*Boston*	*Outports*
Ships and Barks	5,076	4,095	665	918	1,471	1,626
Brigs	2,863	6,545	931	865	1,817	2,322
Schooners and Sloops ...	671	3,208	99	1,714	344	2,405
Total	8,610	13,848	1,695	3,497	3,632	6,353

[80] Information from an examination of the Boston Registers and Enrollments.

the iron ore of Minnesota, the copper of Montana, Arizona, and Utah, and the coal of western Pennsylvania, Ohio, and Kentucky and many other industrial resources still lay in an undeveloped wilderness, and no adequate transportation system existed by means of which an industrial civilization could be created. American manufacturing was not, therefore, a very lusty infant, and in most cases responded badly to protective duties. Furthermore, the country was importing capital and consumer goods from Europe at a rapid rate in order to build up industry, agriculture, and communications.

Consequently the promotion of such a major export industry as shipping notably facilitated the importation of needed products and the payment of interest on loans. It is estimated that during the period 1789–1820 an excess of commodity imports over commodity exports amounting to some $500,000,000 was offset by earnings of foreign exchange and specie by the mercantile marine of between $450,000,000 and $800,000,000.[81] Between 1821 and 1837, however, the $2000,000,000–$250,000,000 so earned failed to offset an increasing unfavorable balance resulting from borrowings on capital account. In addition, in the absence of a strong war fleet, the merchant marine was a major element of American sea power. Hence the state had every reason to foster the maritime industries.

There can be little doubt, furthermore, that the maritime industries were low-cost, comparatively advantageous ones which thoroughly merited promotion at the hands of the state. Shipbuilding was, as has been shown, conducted at a low real and money cost, and its products were readily exported whenever foreign laws allowed. The shipping industry, although without any important natural advantage, nevertheless built on that of the shipbuilding industry because of the registry policy of Europe. In both industries a substantial expansion was possible without steeply rising costs being encountered for some years. The close institutional connection between commerce and navigation also warranted the assumption that the development of the shipping industry would improve the terms of trade. Furthermore, small-scale enterprise

[81] See C. J. Bullock, J. H. Williams, and R. S. Tucker, "The Balance of Trade of the United States, 1789–1914," *Review of Economic Statistics*, 1 (1919), 215–238; reprinted in Taussig, *Selected Readings in International Trade and Tariff Problems* (1921), pp. 159–206.

was the rule, competition among American owners was as keen as economic friction and imperfect knowledge allowed, entry into the two businesses was easy, and capital was necessarily venturesome, with the result that vigorous expansive tendencies existed. There could be no doubt, therefore, that, given a fair field without discrimination and restriction, the United States could become the leading carrier of the world, unless, as was unlikely, England and France abandoned their policies of protecting their shipbuilders.

The United States government accordingly concentrated its energies during this period on the promotion of fair international competition in shipping, and on the securing, if possible, of free navigation. A collision with the mercantilistic policies of Great Britain and France was therefore inevitable. After the Revolution, by an Act of 1783 [82] and the ensuing acts and Orders in Council, the British government imposed the British mercantilistic navigation laws with full force against the United States. This action was contrary to the desires of Pitt, who desired a liberal navigation policy, but he fell from power before he could secure it. Highly discriminating import duties were levied on goods carried in American vessels engaged in direct trade. American vessels were also excluded from British trade to and from the Continent, from Asia and Africa, from the Americas outside the United States, with and between the colonies, between the colonies and the United States, and between the colonies and Europe.[83] The British merchant marine was thus amply protected, and the American shipping industry began to decay. France followed with the Navigation Act of 1793, soon partly suspended, which preserved the colonial and coastwise carrying trades for French ships and restricted the foreign trade to vessels of France and the country of destination.[84] The carrying trade of the world was, in fact, divided and warped by a number of overlapping and conflicting navigation monopolies which not only prevented international competition from being on a fair basis, but also significantly raised the costs of transportation. It was thus highly desirable from both the nationalistic and liberal points of view to remove these restrictions.

[82] 23 Geo. III, c. 39.

[83] See J. B. McMaster, "The Struggle for Commercial Independence," *Cambridge Modern History*, VII, 309–310.

[84] Lefol, p. 13.

The American policy was at first to counter-attack with similar restrictions. Under the Confederation the states individually discriminated against foreign vessels, — New York with double import duties in 1785, Massachusetts in the same year with a prohibition on exportation in British ships and a heavy tonnage duty on foreign vessels, New Hampshire with a treble tonnage tax in 1784, and Pennsylvania, Virginia, Maryland, and Rhode Island soon afterward with similar restrictions.[85] The new national government during its early years continued and developed these policies. In 1789 a law levying discriminating duties on goods imported in foreign ships was passed.[86] In general, goods carried in American vessels were allowed a 10 per cent reduction, but in 1790 the provision was altered to a 10 per cent increase on goods carried in foreign craft.[87] In addition, importers using American vessels were allowed a long period to pay. This was an ineffective policy, however, for many goods were either on the free list or were subject to small duties. Hence in 1789 another bill became law levying discriminatory port dues, the rates being six cents per ton for American ships and fifty cents per ton for foreign-built and foreign-owned vessels.[88] Furthermore, foreign ships were discriminated against in the coastwise trade because they were required to pay the dues on each arrival, whereas American vessels in the coasting trade and fishing business paid them but once a year. The long-voyage trade to China was also protected by a special provision in the first Act of 1789. The rates of duty on tea were set at from six to twenty cents per pound, depending on the kind of tea, if imported directly in American ships, from eight to twenty-six cents if imported from Europe in American ships, and from fifteen to forty-five cents if imported in foreign ships. On other East India goods the rates were nearly double if they were imported in foreign vessels. A feature of the provision dealing with port dues was the effort to encourage the sale of American ships abroad by means of a relatively favorable rate of thirty cents per ton for American-built, foreign-owned vessels. Furthermore, the shipbuilders were protected by the

[85] McMaster, pp. 309–310; M. M. McKee, "The Ship Subsidy Question in American Politics," *Smith College Studies in History*, VIII (1922–23), 10.
[86] 1 U.S. Stat. 24 (July 4, 1789).
[87] 1 U.S. Stat. 180 (Aug. 10, 1790).
[88] 1 U.S. Stat. 135 (July 20, 1789).

Registry Act of 1789, later to become of the utmost importance, which limited American documentation to American-built vessels and those already owned.[89]

This system proved to be burdensome to all concerned. A notable feature of this episode was the fact that for the first time navigation monopolies and restrictions were being imposed by rival maritime nations located at opposite ends of what were to be the major seaborne trade routes. The United States was thus in a much better position to retaliate against the British monopolies than Holland, France, and Spain had been. The rise of the United States, indeed, made the Cromwellian system impossible, for if retaliation was pushed to the limit the transatlantic, West Indian, and other trades could be completely checked.[90] The struggle therefore drifted into a stalemate until after the wars were over.

These were, as we have seen, favorable to the United States, which was the chief neutral carrier. The result of the wars and the discriminations was such that the American marine gradually secured an overwhelmingly strong position in the foreign trade of the country. A careful compilation shows that the proportion of American tonnage in the port entries rose from 53 per cent in 1789 to 94 per cent in 1796, after which it varied between 94 and 82 per cent until 1812.[91] Hence it may be concluded that the

[89] 1 U.S. Stat. 55 (Sept. 1, 1789).

[90] W. S. Lindsay, *Our Merchant Shipping, its Present State Considered* (1860), pp. 10–11.

[91] The following table was compiled by E. T. Chamberlain, Commissioner of Navigation, R.M.M.C., 1,764–1,765:

AMERICAN AND FOREIGN TONNAGE ENTERED AT U.S. PORTS, 1789–1814

(*000 omitted*)

Calendar Year	*American*	*Foreign*	*% American*	*Calendar Year*	*American*	*Foreign*	*% American*
1789	124	110	53	1802	799	147	84
1790	355	251	59	1803	787	164	83
1791	364	241	60	1804	1133	122	90
1792	415	244	63	1805	922	88	91
1793	448	164	73	1806	958	91	91
1794	526	83	86	1807	1020	87	92
1795	580	57	91	1808	492	48	91
1796	675	47	94	1809	576	99	85
1797	608	77	88	1810	876	80	91
1798	522	86	85	1811	922	33	96
1799	626	110	85	1812	656	47	93
1800	644	124	82	1813	234	112	67
1801	799	158	83	1814	59	48	55

policy of discrimination was remarkably successful in protecting American shipping.

It would be a mistake, however, to assume [92] that the high percentage of American tonnage entered indicated a desirable state of affairs, for the rival policies of the nations added to the costs of navigation and shipment, interfered with the rational employment of tonnage and altered the normal course of trade. The American government strove, therefore, to secure a more economical, rational, and equitable system throughout the world. The injustice done by unfair competition to the mercantile, shipping, and shipbuilding interests, and the injury done by foreign protectionism to the prestige and naval power of the United States clearly required, however, at least for the time being, strong counter actions. Jefferson summarized admirably the fighting, free-navigation philosophy of the government in his report of 1791 as follows:

> Were the ocean, which is the common property of all, open to the industry of all, so that every person and vessel should be free to take employment wherever it could be found, the United States would certainly not set the example of appropriating to themselves exclusively any portion of the common stock of occupation. They would rely on the enterprise and activity of their citizens for a due participation of the benefits of the seafaring business, and for keeping the marine class of citizens equal to their object. But if particular nations grasp at undue shares, and, more especially, if they seize on the means of the United States to convert them into an aliment of their own strength, and withdraw them entirely from the support of those to whom they belong, defensive and protecting measures become necessary on the part of the nation whose marine resources are thus invaded, or it will be disarmed of its defense, its productions will be at the mercy of the nation which has possessed itself exclusively of the means of carrying them, and its politics may be influenced by those who command its commerce.[93]

American policy at this time was thus primarily defensive.

Beginning in 1815 the drive to secure free navigation became intensified. In that year, by the Reciprocity Act,[94] the President was empowered to allow the ships of any nation, carrying the goods of that nation, to enter American ports on the same terms as those on which American ships were received in the ports of that nation, thus opening the door to free navigation in the direct

[92] As W. W. Bates does in his *American Marine*, chap. vii.

[93] *Report on Commercial Intercourse with Foreign Nations* (1822), p. 642.

[94] 3 U.S. Stat. 224 (March 3, 1815).

trade. A reciprocity treaty was also concluded with Great Britain on July 3, 1815, which gave American vessels free and fair entry into Britain and her possessions in Europe. This treaty, among other things, enabled the packet service to be started. This policy was, in fact, forced on Great Britain by circumstances, for the discriminatory measures of the United States and the new nations of South America were proving to be very effective.[95]

Further measures designed to secure fair competition, or at least to retaliate against unfair competition, were undertaken after 1815. The next step was the Navigation Act of 1817,[96] which was aimed at the shipping of foreign powers employed in indirect carrying trades. Modeled on the Restoration Act of Great Britain, it prohibited the importation of goods in foreign ships, except those of the country of origin, but, unlike that act, it provided for the reciprocal removal of this restriction. It also completely closed the coastwise carrying trade to foreign ships, although they could still sail coastwise without cargo. Henceforth only vessels built and owned in the United States could engage in this trade. As the coastline of the nation was extended this became the most important protective policy concerning shipping and shipbuilding. Another law aimed at foreign navigation monopolies was passed in the same year. It removed extra tonnage dues, assessed at the high rate of $2 per ton, which had been levied during the War of 1812, the removal to apply to all foreign craft except those arriving from ports from which American ships were not ordinarily allowed to trade.[97] In another measure of 1818,[98] more pressure was added by closing United States ports to British ships coming from any British colony the ports of which were closed to American craft, and by requiring a bond of double the value of the cargo from foreign owners not to land American goods in such closed ports. Great Britain, in a final effort to maintain the old system, had closed the West Indian ports to American ships in 1783, and, although the regulations had been relaxed during the Napoleonic Wars, they were still effective in 1818, and were to remain so until 1830. Against this action this bill was designed to retaliate. Although the trade was consequently se-

[95] Lindsay, *Our Merchant Shipping*, pp. 15–18.
[96] 3 U.S. Stat. 351 (March 1, 1817).
[97] 3 U.S. Stat. 344 (Jan. 14, 1817).
[98] 3 U.S. Stat. 432 (April 18, 1818).

verely hampered it was still possible to do business by means of the entrepôts at St. Eustatius and other Dutch and French islands. A special measure aimed against France because of the severe discrimination encountered by American ships in French ports, especially by those in the cotton trade, was also passed in 1820. This law levied prohibitory port dues of $18 per ton on French vessels.[99] A treaty was consequently forced on France in 1822 and was ratified in 1823.[100] This measure substantially, but not entirely, reduced discrimination on both sides. These measures made it plain that discrimination would be effectively combatted.

A further regularization of navigation was achieved in 1824 when a special reciprocity law was passed removing all discriminating duties on tonnage and imports affecting the shipping engaged in the direct carrying trades to the maritime powers of the Netherlands, Prussia, Hamburg, Bremen, Lübeck, Oldenburg, Sardinia, and Russia in return for similar privileges.[101] Colombia was later also included.[102] Many of these countries, especially those in the Baltic, were low-cost carriers, and consequently were in a position to secure a very substantial portion of the business.

The reciprocity policy was also again renewed and reëmphasized in the Reciprocity Act of 1828,[103] one of the primary American navigation measures, which offered to open the indirect as well as the direct trades on a fair basis to the ships of such foreign nations as would grant the same privileges to United States ships. Its aim was thus to secure unrestricted navigation for American ships. In 1830, a further special act provided for the reciprocal opening of the British West India trade.[104] The policy thus persistently followed was, indeed, highly successful in opening the carrying trades of the world to the low-priced Yankee ships.

The United States thus became the leader in the development of the modern system of free navigation. In this respect it was followed, at first unwillingly, by Great Britain, which concluded numerous reciprocity treaties during the first half of the cen-

[99] 3 U.S. Stat. 605 (May 15, 1820).
[100] U.S. Treaties (Malloy, 1910), pp. 521–523.
[101] 4 U.S. Stat. 2 (Jan. 7, 1824).
[102] 4 U.S. Stat. 151 (April 20, 1826).
[103] 4 U.S. Stat. 308 (May 24, 1828).
[104] 4 U.S. Stat. 419 (May 29, 1830). This act was placed in effect by a proclamation of Oct. 5, 1830.

tury.[105] The effect of the gradual extension of the system in each case was to increase the volume of commerce beyond what it would otherwise have been by reducing costs and making communication more direct.

The effect on the competitive position of the American shipping industry varied, however, from trade to trade. In general the policy left the position to be determined by natural advantage, rather than by discrimination. In the case of the carrying trades to Great Britain, France, and Spain, American vessels in general had a great advantage over those of these nations, and consequently dominated the direct routes; but in competition with vessels of Holland, Hamburg, Bremen, and the Baltic powers the advantage was less marked. Furthermore, there were many restrictions on multiangular voyages which favored the vessels of certain nations. The United States, for example, secured a favorable position in the triangular cotton trade because of the closed coastwise trade. The policy also opened to some foreign ships some branches of the American carrying trade which had been closed, such as those to the Far East. Some increase in the proportion of foreign tonnage among that arriving in American ports was thus inevitable, but this increase was not incompatible with a sound expansion of the shipping industry. The proportion of American tonnage in the total entering American ports from abroad remained extremely high, in fact, until after 1830, when the rising costs in the United States, the improvements in shipbuilding abroad, and the establishment of free navigation in the West India trade caused a moderate fall. From 76 per cent in 1815 the proportion rose to 91 per cent in the depression year 1819, and remained between 91 and 85 per cent until 1830, after which there was a decline to 77 per cent in 1831 and 71 per cent in 1832.[106] Meanwhile, the volume of American-flag entrances and

[105] J. H. Clapham, "The Last Years of the Navigation Acts," *English Historical Review*, xxv (1910), 480–485.

[106] The figures below are, for 1815–1820, from Chamberlain, R.M.M.C., iii, 1765; for 1821–1830, from A.R.C.N. (1914), pp. 148, 150. The figures for entries alone are also continued there.

Calendar Year	*Tons of Shipping Entered* *American*	*Foreign*	*% U.S.*	*Value of Exports & Imports Carried in U.S. Ships—%*
1815	695	216	76	No reliable statistics available
1816	877	259	77	
1817	780	212	79	
1818	755	161	82	

clearances rose from 1,570,045 tons in 1815 to 1,938,987 tons in 1830.

There was thus every reason to believe that the government's view that free navigation would provide the American marine with all the trade which it could economically carry and would increase the total amount of business by opening new employments was well founded. When full freedom of navigation could not be secured the establishment on particular routes of fair bilateral competition was beneficial. The alternative policy of establishing rigid monopolies and severe discriminations, which would have provoked serious retaliation, would have disrupted trade and been ultimately injurious to the shipping interests, although the percentages of the traffic carried might conceivably have been higher. The reciprocity policy met, in fact, with a very considerable measure of success. By 1830 American vessels could sail with substantial freedom and under conditions of fair competition between American ports and the United Kingdom, France, Norway, Sweden, Holland, Prussia, Hamburg, Bremen, Lübeck, Oldenburg, Russia, Sardinia, Austria, Denmark, and Brazil, with all of which reciprocity arrangements had been negotiated, and with the British West Indies.[107] Many indirect trades were still closed, however, and hence American ships were to a considerable extent confined to the direct routes radiating from the United States and to the international tramp-ship business in a few regions, such as South American and Oriental waters. In the trades having fair competition the merchant marine exhibited great vigor. It seems evident that the policy was successful from the maritime, naval,

1819	784	86	91	
1820	801	79	91	
	Tons Entered and Cleared			
1821	1,570	165	90	88
1822	1,502	198	88	88
1823	1,586	239	86	90
1824	1,769	205	90	91
1825	1,841	188	91	92
1826	1,895	205	89	93
1827	1,898	269	88	91
1828	1,766	301	85	89
1829	1,818	264	87	90
1830	1,939	265	88	90

[107] Keiler, pp. 49–54; U.S. Treaties (Malloy, 1910): Great Britain, 1815, p. 624; France, 1822, p. 521; Austria–Hungary, 1829, p. 29; Denmark, 1826, p. 373; Brazil, 1828, p. 133; 4 U.S. Stat. 151 (1826) covers the remainder.

and commercial standpoints. The shipping and shipbuilding industries were expanded, the wartime value of the merchant marine was enhanced, transportation costs were reduced, and traffic was induced to flow more rationally. It is hard to see, therefore, how this policy can be criticized either from the liberal or nationalistic viewpoints.

CHAPTER IX

THE GOLDEN AGE OF THE AMERICAN WOODEN SAILING SHIP: THE FIRST GREAT BOOM
1830–1856

I

DURING THE LONG PERIOD between the War of 1812 and the Civil War, a marked alteration in the economic character of the maritime industries took place, with the result that many of the medieval features of the earlier small-scale industries were supplanted by others somewhat more modern. The year 1830, which stands at the beginning of a long period of expansion in the volume of trade, is a convenient date line marking the beginning of a new period.

One major change was the rapid expansion in world seaborne trade as a result of the rapid progress of the Industrial Revolution, by then well advanced, which brought with it the concentration of industry, the agglomeration of population, the mass transportation of raw materials from distant places, and the mass shipment of manufactured consumer and producer goods to distant markets. It also brought the ascendency of British enterprise, which was the first to mature after the Industrial Revolution. With the development of British economic power came the economic systems of free trade and free navigation — the twin ideals of the British liberal economist. These widened the markets of the British producer, who was well fortified by technical leadership and substantial economies of scale. The resulting carrying trade became to a large extent, however, the preserve of the American wooden sailing ship.

On land the basis for a new and larger-scale commerce was laid with the construction of railways, canals, and other means of inland transportation, which enormously increased the hinterlands of the seaports and caused the concentration of bulk cargoes on a scale formerly unknown. In the United States the railroad network increased rapidly, beginning with the Baltimore & Ohio,

which was chartered in 1827 and was partly completed by 1830.[1] It extended to 2818 miles in 1840, 9021 miles in 1850, and 30,626 miles in 1860.[2] Starting in the 'forties, through rail routes to the Mid-West were completed, and consequently western grain and cotton began to move in the transatlantic trade in considerable volume. A similar growth took place abroad. The railway network of Great Britain amounted to 5000 miles by 1848, at which time much of the modern system had been laid out;[3] that of what was later to be the German Empire to about 3000 miles in 1850;[4] and that of France, which was somewhat behind, to about 2000 miles in 1851.[5] The rise of the railway networks was, indeed, a revolutionizing and relocalizing factor of the first importance, as Clapham emphasizes. This was particularly true of its effect on the world's shipping industry.

Other factors also contributed to change. The progress of technical innovation produced new processes and industries which, for the most part, obtained some economies of scale, and hence became centralized to a considerable degree. These industries required extensive shipping facilities in order to secure their materials and to reach their markets. For instance, new processes in the iron industry and the rising demand for iron for use in railroads, bridges, boilers, engines, and machinery, enormously increased the output of pig iron. The annual production in Great Britain rose from 442,000 tons in 1823 to 3,826,700 tons in 1860, an average annual rate of increase of 5.9 per cent. This rate was higher than at any other period in British history.[6] The export of capital and capital goods also began on a large scale during this period,[7] and resulted in a large demand for tonnage on the trade routes radiating from Northwest Europe. The large increase in the populations of Europe and the Americas resulting from the geographical, technical, and transportation revolutions and the bringing of other masses in the Far East within the sphere of the

[1] Locklin, p. 43. See also Eliot Jones, *Principles of Railway Transportation* (1931), chap. iii.

[2] *Statistical Abstract of the United States, 1916*, p. 293.

[3] Clapham, *Economic History of Modern Britain*, I, 392.

[4] Clapham, *Economic Development of France and Germany, 1815–1914* (1928), p. 153.

[5] Clapham, *Economic Development of France and Germany, 1815–1914*, p. 153.

[6] W. Bowden, M. Karpovich, and A. P. Usher, *An Economic History of Europe Since 1750* (1937), pp. 381–385.

[7] See L. H. Jenks, *The Migration of British Capital to 1875* (1927).

interdependent capitalistic exchange economy were also changes of first-rate significance. The population of the United States rose from 4,000,000 in 1789 to 31,000,000 in 1860; that of Great Britain from 14,997,000 in 1800 to 29,925,000 in 1865; and that of France from 27,200,000 to 38,020,000 in the same period. The other European states, some of which, however, were only slightly affected by seaborne trade, made substantial gains as well.[8] Thus the total number of persons in North and South America, Europe, and Asia whose economic life was bound up with ocean trade was very much greater in 1860 than in 1815 or at any earlier time.

The volume of shipping activity consequently increased greatly, although the industry of building wooden ships, which until 1860 supplied most of the tonnage, was operating under conditions of sharply rising costs, especially in the latter part of the period. In the United States the total tonnage of vessels of all flags entered and cleared in the foreign trade rose from 2,204,323 tons in 1830 to 17,065,125 tons in 1860, an increase of nearly 800 per cent.[9] Similar figures for Great Britain, the trade of which was a measure of that of the entire world, show an increase from 5,799,385 tons to 24,689,292 tons between the same years.[10] A comparison of averages of British trade for the years 1821–1830 and 1861–1870 shows an increase in wheat imports of sixteen times, of cotton imports of over five times, of wool imports of nine times, of coal exports of twenty-nine times, all by physical volume; and of cotton goods exports of three and one-half times, of iron and steel exports of fifteen and one-half times, and of exports of machinery and millwork of twenty-two times, all by value.[11] There was consequently ample opportunity for the expansion of the merchant fleets of all nations. The tonnage of the United States engaged in all employments rose from 1,191,776 tons in 1830 to 5,353,868 tons in 1860,[12] and that of the entire British Empire from 2,531,819 tons to 5,710,968 tons between the same years.[13] The maritime development of each nation was con-

[8] Bowden, Karpovich, and Usher, pp. 1–22.

[9] A.R.C.N., 1914, p. 150.

[10] A.R.C.N., 1901, pp. 482–483.

[11] Bowden, Karpovich, and Usher, pp. 408–409. The figures for iron and steel compare the years 1822–1860 and 1862–1870, and those for machinery the years 1827–1830 and 1867–1870.

[12] A.R.C.N., 1914, pp. 186–189.

[13] A.R.C.N., 1901, pp. 470–471. The British figures for the latter year are in

ditioned, however, by the growth of commerce on its own primary ocean trade routes, the elasticity of supply of the factors of production employed in shipping and shipbuilding, the degree of technical development secured, the existence of monopolistic and protective elements, the general efficiency of enterprise, and the effects of the various navigation laws on the geographical layout of the national shipping routes.

2

The North Atlantic carrying trade began to assume an increased relative importance under these conditions. The United States packet services, already established, expanded under the influence of the rising immigrant, cabin passenger, and general-cargo trades, and the vessels employed, which by 1850 were approaching the then huge size of 1500 tons register, were recognized as being among the best in the American marine, and, indeed, in the world.[14] Only the British firms Wigram & Green of London, and Smith of Newcastle, which built passenger vessels for the eastern trades, turned out comparable ships.[15] The number of persons crossing the Western Ocean became large for the first time during this period. Over 90 per cent of those arriving in the United States were immigrants, most of which were of European origin. The number of passengers arriving by sea at United States ports, which had been a mere 10,311 in 1820, and only 24,837 in 1830, rose in surges to 92,207 in 1840, and, as a result of short food supplies, especially in Ireland, and of political disturbances on the Continent, to very high levels in the late 'forties and early 'fifties, reaching 119,896 in 1845, 315,334 in 1850, and record level of 460,474 persons in 1854.[16] The rise of the passenger trade is indicated approximately by the accompanying table, which, however, also includes arrivals from Canada and other places. The third column is the best indicator of the extent of the immigrant trade.

net tons, whereas the American are in gross tons, and hence the British expansion is somewhat understated, since both returns are in gross tons for the earlier year. See the discussion, A.R.C.N., 1914, p. 469.

[14] See for instance the statement of H. C. Chapman, shipowner and agent for American packet lines, *Report of the* [British] *Select Committee on Merchant Shipping* (1844), pp. 61–68.

[15] Chapman, *Report of the* [British] *Select Committee on Merchant Shipping* (1844), p. 66.

[16] I. Ferenczi and W. F. Willcox, *International Migrations*, 2 vols. (1929), I, 397.

There was, therefore, a substantial expansion of the packet service, which was almost exclusively dominated by United States ships. The number of vessels engaged in the two-way transatlantic packet service from New York to Europe, in which the best liners were used, rose from thirty-six in 1830 to forty-eight in 1840, and fifty-six in 1855.[17] In the latter year, there were in the services

PASSENGERS ARRIVING IN THE UNITED STATES, BY FIVE–YEAR INTERVALS 1820–1860[18]

Fiscal year	*Total passengers*	*Aliens*	*Europeans aliens*
1820	10,311	8,385	7,691
1825	12,858	10,199	8,543
1830	24,837	23,322	7,217
1835	48,716	45,374	41,987
1840	92,207	84,066	80,126
1845	119,896	114,371	109,301
1850	315,334	310,004	250,939
1855	230,476	200,877	187,729
1860	179,691	153,640	141,209

to Liverpool twenty-four ships, to London sixteen ships, and to Havre sixteen ships.[19] Competition became exceedingly keen, and only the best vessels remained in operation. The famous Black Ball Line added twenty-one ships to its fleet between 1830 and 1858, most of which were built by New York's foremost ship-builder, William H. Webb; the Red Star Line added twelve; the Liverpool–Blue Swallowtail Line sixteen; the London Black X Line, eighteen; the London Red Swallowtail Line, twenty; the First Havre Line, sixteen; the Second Havre Line, eight; the Havre–Whitlock Line, twelve; and two newcomers, the Collins–Dramatic Line to Liverpool, ten; and the New Line to Liverpool, five.[20] The majority of these were new ships when they began their service, and had been proudly announced as "built without regard to cost." The Dramatic Line was established in 1837 by Edward Knight Collins, who was later to make a poorly advised and poorly managed venture in steam navigation, and began operations with four splendid sailing ships, the *Shakespeare*, *Garrick*,

[17] Albion, *Square-Riggers on Schedule*, p. 274.
[18] Ferenczi and Willcox, pp. 377, 380, 397.
[19] Albion, *Square-Riggers on Schedule*, p. 274.
[20] Albion, *Square-Riggers on Schedule*, Appendix II.

Siddons, and *Sheridan*, the last three being sister ships of 895 tons. In 1838 he added the *Roscius*, 1030 tons, the first of the large ships of the packet fleet.[21] The other new line from New York was operated by Woodhull and Minturn. In addition, Enoch Train's noted line of Liverpool packets sailing from Boston, for which seven superb liners were built by Donald McKay, was founded in 1842.[22] Thus there was intense activity in the building and operating of the packets, the firms became larger and more numerous and acquired greater prestige, and regularly scheduled sailings to and from Europe in first-class vessels became very frequent.

These were not the only passenger vessels, however, for the rise of the complementary cotton and immigrant trades produced a great number of regular traders, which sailed around the cotton triangle and carried from 300 to 600 immigrants in the 'tween decks when westbound. Most of these vessels were large, strong, and buoyant, but they were fuller of line than the packets, and made slower passages. Their facilities for caring for so many persons were often most inadequate, with the result that the death rolls, which sometimes reached 20 per cent or more, were a disgrace to the merchant marine. Nevertheless, probably many more immigrants, who were mainly recruited on a commission basis by agents located in the chief European ports, saw America first from a combination vessel than from a regular liner. Other regular traders engaged in the general cargo and provision trades eastbound from North Atlantic ports also entered the immigrant business. The vessels of this type were frequently organized into lines, but their sailings were quite irregular. Some of these firms made special provision in the design of their vessels for immigrants. Many also carried cabin passengers. Among the more important firms may be mentioned the St. George Line, owners of the famous *Dreadnought*, and D. & A. Kingsland, Williams & Guion, and Augustus Zerega, all of New York. Many owners in Boston, Newburyport, Portsmouth, Portland, and Bath also engaged in this business. These strong economical ships were an important part of the American merchant marine during this period.

The American packet ships and combination vessels completely

[21] Albion, *Square-Riggers on Schedule*, pp. 43–44.

[22] A. H. Clark, pp. 54–56; Albion, *Square-Riggers on Schedule*, p. 47.

dominated the North Atlantic passenger trade until about 1857, despite the rise of steamship lines. In the early 'forties the British-flag Cunard steamships began to be a threat to their supremacy, and later the Collins, Bremen, Havre, and Inman lines also invaded the field, but the increase in traffic was so great that the owners of sailing ships suffered scarcely any loss in business. No foreign lines of sailing packets of any significance appeared in the trade until the founding in 1847 of the Hamburg–American Line, which at first operated four 700-ton sailing ships. This firm significantly had access to a low-cost shipbuilding area. The prestige of the American packets was very great throughout this period, and was due to the prompt departures, able commanders, fast passages, and excellent condition in which cargo was discharged.[23] They consequently enjoyed the preference of shippers, and normally received higher freight rates than other craft.[24] The combination ships, although second choices, also received good patronage. In bad times, however, their owners and captains often found it necessary to sail them westward in ballast with only immigrants on board.[25] Westbound cargoes normally consisted of such heavy articles as iron, coal, salt, machinery, manufactures, and copper. Eastbound, the vessels usually rode light with cotton, and hence sailed fast, whether out of New York or southern ports. Although the British government looked longingly at this carrying trade, British owners testified that the capital charges on comparable high-cost British-built vessels made competition impossible.[26] This situation was probably one circumstance leading to the establishment of the British subsidized steamship service in 1840. The steam vessels secured, however, only a small proportion of the passenger business until after 1856. The proportion of the passengers arriving at New York carried in steamers was, indeed, but 3.6 per cent in that year.[27] It is evident, therefore, that the big American packets controlled a large part of the trade.

[23] *Report of the* [British] *Select Committee on Merchant Shipping* (1844), pp. 61, 65.

[24] *Report of the* [British] *Select Committee on Merchant Shipping* (1844), p. 57.

[25] *Report of the* [British] *Select Committee on Merchant Shipping* (1844), p. 66.

[26] *Report of the* [British] *Select Committee on Merchant Shipping* (1844), p. 57.

[27] "Castle Garden Report," *Annual Report of the New York Chamber of Commerce, 1859–1860*, pp. 276–279. (This source is hereafter cited as *R.N.Y.C.C.*)

3

Of the general carrying trades none was more important as a staple employment for American ships during this period of expansion than the cotton trade. In the shipbuilding towns, especially those in Maine,[28] the great, bluff-bowed, flat-floored, kettle-bottomed cotton freighters, the size of which rapidly increased from about 400 gross tons in 1830 to about 1400 gross tons by 1850, and which were usually distinguished by their white stripe and black ports, were to be seen under construction in large numbers. Many had names suggestive of their trade, such as *Alabama*, *Lancashire*, and *Arkwright*.

The cotton carrying trade expanded rapidly after the invention of the cotton gin in 1793, which enabled the cultivation of short-staple cotton to be undertaken. The momentum of this expansion was especially great during the 'forties and 'fifties because of the agricultural exploitation of vast southern lands, the use of a large slave-labor supply, the opening of rail and water transportation to the ports of New Orleans, Mobile, Savannah, and Charleston, and the apparently unlimited demand of Lancashire. The production of cotton rose from 732,218 bales in 1830 to 1,347,640 bales in 1840, to 2,136,083 bales in 1850, and to a temporary peak of 4,309,642 bales in 1859.[29] Exports rose from 553,960 bales in 1830 to 1,060,408 bales in 1840, to 1,854,474 bales in 1850, and to 3,535,373 bales in 1859. The majority of the freighters employed in this trade went around the three sides of the triangle, sailing some 700 to 800 miles from New York or New England to Charleston or Savannah, or some 1700 miles to the newer loading ports of New Orleans or Mobile, and thence to Liverpool or Havre. A considerable amount of cotton was, however, brought coastwise to New York in the coastwise packets, and there transshipped. The exact amount of tonnage employed cannot be determined, but it was estimated in 1852 that some 800,000 tons of American shipping employing 40,000 men were engaged in the foreign portion of the trade.[30] This comprised

[28] Eaton, *History of Thomaston*, I, 406; P. McC. Reed, pp. 151–152.

[29] Sherer, pp. 419–420.

[30] I. D. Andrews, *Report on the Trade and Commerce of the British North American Colonies and of the Great Lakes and Rivers* (1852), House Exec. Doc. no. 136, 32 Cong., 2 Sess., pp. 833–834.

about 47 per cent of the registered fleet. It was also estimated that the coastwise shipping so employed amounted to 1,100,000 tons, manned by 55,000 seamen, or 55 per cent of the tonnage documented for the coastwise trade. The prosperity of the northern seaports and shipping interests was thus closely tied to cotton, a fact which later became a great weakness.

The American ships engaged in this trade possessed notable competitive advantages. The great volume of cargo available produced bigger freighters than had formerly been constructed. For the first time in American trade a large active freight market developed in which these ships were chartered. The new cargo carriers, unlike most foreign vessels, had broad flat bottoms on account of the shallow water on the Mississippi bar. They also had greater length than had been customary, and swollen sides. They proved to be good sailers, and could carry some 2000 pounds of cotton per registered ton in comparison with but 900 pounds in the freighters of about 1810.[31] In general, they were thought to be superior to the shorter, smaller, and proportionately deeper British craft, although some of these latter were free from defects.[32] By virtue of their excellent construction and clean cargo turnout American cotton ships also commonly received a freight premium at this time.[33] In addition, they were protected by the navigation monopoly on the coastwise leg of the voyage. Consequently they dominated the trade, carrying some 75 or 80 per cent of the cargoes.[34] In 1855, for instance, 480,505 tons of American-flag shipping left New Orleans for foreign ports, compared with but 123,900 tons under foreign flags. In all of the American shipping centers the building and operation of cotton ships was a prominent activity during these years.

4

A third major factor in the expansion of the American marine was the traffic resulting from the gold rush to California, which

[31] Testimony of Joshua Bates, *Report of the* [British] *Select Committee on Manufactures, Commerce, and Shipping* (1833), pp. 49–51.

[32] *Report of the* [British] *Select Committee on Manufactures, Commerce, and Shipping* (1833), pp. 49–51.

[33] *Report of the* [British] *Select Committee on Manufactures, Commerce, and Shipping* (1833), pp. 50–51; Lynch Report, p. 4.

[34] *Report of the* [British] *Select Committee on Manufactures, Commerce, and Shipping* (1833), p. 53.

began in 1849, and the subsequent settlement of that region. The effect of this extraordinary episode was to add a substantial amount of tonnage to the American marine at a time when other trades were extremely active. In 1835, when Dana visited the West Coast, the old fur trade had largely died out, and only a few hide droghers and whalers were to be seen. In contrast, 775 vessels cleared from eastern ports for California in 1849, and several hundred departed annually during the next eight years, all in consequence of the rush of prospectors to stake out claims and the equally frantic haste of eastern merchants to supply consumer goods to the San Francisco market, where the scarcity of commodities in relation to the supply of gold produced extraordinarily high prices, which were sometimes as much as ten times those in eastern ports. Hence merchants were willing to pay extraordinary freight rates in order to secure space and a rapid passage to the market. At the peak of the boom the new, large, fast clipper ships, which were the product of these economic conditions, loaded at rates as high as $60 per cargo ton — rates far in excess of the normal rate levels, which ranged approximately from $10 to $12 per cargo ton. Hence the huge freight revenues of some clippers, which ranged from $75,000 to $125,000, were nearly sufficient to pay off the capital cost of the ship on one voyage.[35] Never had American shipowners had such a profitable era.

The effect of this boom fell primarily on the American merchant marine, for in consequence of the annexation of California in 1846 during the Mexican War and the subsequent inclusion of the 16,000-mile Cape Horn voyage in the coastwise navigation monopoly the entire supply of vessels for the California trade had to be secured from the American fleet employed in other trades and from the American shipyards. Hence it was only as American shipping was withdrawn from its normal employments that foreign shipping felt the impact of the boom. A few foreign vessels were employed, however, in carrying out prospectors from Europe and other areas. The navigation monopoly and registry law thus became, for the first time, strongly protective and restrictive. Foreign shipping began to press against the monopoly. There were available at this time in Canada, Great Britain, and other nations large numbers of vessels which could have been used to relieve the relatively high inelasticity of supply in the United States, but

[35] A. H. Clark, pp. 103–104, 290.

it was impossible to do this. Hence the boom was confined mainly to American shipping.

Both the shipping and shipbuilding industries felt the effect of the boom strongly. It may be estimated that from 1850 to 1853 between 200,000 and 300,000 tons of shipping, much of it new, were employed in the California trade. This fleet amounted to from 13 to 19 per cent of the registered tonnage.[36] The arrivals at California from eastern ports in the latter year amounted to 282 vessels of 206,279 tons.[37] The effect on shipbuilding was equally startling. Although no complete statement of the tonnage built for this trade is available, it is probably not unreasonable to accept the number of clippers built as a fair indication, for most of these were employed in this business. Two tabulations of construction activity have been made for the years 1850–1859. The first of these, made by Clark, which covers only the extreme clippers, shows a total output of 172 vessels of 224,545 gross tons, which number was only 7 per cent of the 2466 ships and barks built. The second one, made by Cutler, which includes nearly all fast vessels, some of which did not engage in the trade,

CLIPPER SHIPS BUILT IN THE UNITED STATES 1850–59[38]

Year	*Extreme clippers (Clark)* No.	*Extreme clippers (Clark)* Tons	*Clippers (Cutler)* No.	*Clippers (Cutler)* Tons	*No. of ships and barks built*
1850	13	14,368	24	20,083	247
1851	31	38,478	54	58,981	211
1852	33	41,401	76	73,974	255
1853	50	73,996	120	150,699	270
1854	20	24,763	71	85,821	334
1855	13	16,846	42	52,045	381
1856	8	10,271	38	41,427	306
1857	4	4,422	10	9,055	251
1858	..	....	6	6,126	122
1859	..	....	3	2,470	89
Total	172	224,545	444	500,681	2,466

[36] California-bound ships sailed under registers.

[37] "Commerce Between the Atlantic and Pacific Ports of the United States by Cape Horn and the Panama Route," in U.S. Treasury Department, *Report on the Internal Commerce of the United States*, 1880, p. 59. (Hereafter cited as R.I.C.)

[38] Compiled from A. H. Clark, Appendix 1; Cutler, Appendix 1 (c). These figures are for calendar years. Those in the last column, taken from the A.R.C.N., 1901, p. 582, are for fiscal years ending June 30.

shows an output of 444 vessels of 500,681 tons, or 18 per cent of the number. The true figure probably lies somewhere between, although the generally larger size of the California ships would make a tonnage comparison more favorable to them. These figures showing the construction of clipper ships are given in the accompanying table.

The development of the California trade was closely related to that of other long-voyage branches of navigation. Most important of these was the China tea trade, which provided homeward cargoes to New York and London for the California clippers. These ships otherwise would have had to return either in ballast or laden with low-grade cargoes. The repeal of the British navigation acts in 1849 opened the British section of this tea trade to American vessels.[39] For the owners of these Californiamen the tea trade was, despite the favorable rates which they secured, largely a subsidiary employment. For others, however, it was as formerly a principal business, but such firms generally operated smaller and more economical clippers. The first American clipper to reach England after the repeal, the *Oriental*, 1003 tons, which had been built especially for the China trade, arrived at London in 1849 and excited much interest.[40] Both the specially-built American China clippers and the Californiamen loaded teas at rates double those of English vessels in consequence of their ability to reduce the passage from about 180 days to about 100 days. American participation in this tea trade from China to England on a large scale did not, however, survive the collapse of the California trade, although the regular American tea clippers continued to sail to the United States. California clipper ships also went home by way of Europe loaded with guano from the Pacific Islands, which was rapidly coming into favor as a fertilizer. Still others loaded whale oil at the depots which were arising in the Hawaiian Islands and elsewhere. It was difficult, however, to find any normal employments in which the freight rates were high enough to meet the heavy operating expenses of these clippers. Hence, with the decline of the California trade, the construction of extreme clippers ceased.

Another development which gave employment to a limited num-

[39] 12 & 13 Vic., c. 29 (June 26, 1849).

[40] A. H. Clark, pp. 97–99; Basil Lubbock, *The China Clippers* (1914), pp. 106–108.

ber of American clippers, caused the sale of others to British owners, and in general still further tightened the freight markets, was the discovery of gold in Australia in 1851. The English Black Ball Line, which by 1860 owned eighty-six vessels, the White Star Line, and other owners thereafter for about seven years bought and chartered American ships freely for the carrying trade between England and Australia, in which boom conditions prevailed for a time. Among the most noted purchases made were the clippers *Lightning*, *James Baines*, *Champion-of-the-Sea*, and *Donald McKay*, which were built by Donald McKay at East Boston, and the *Red Jacket*, a product of George Thomas of Rockland. American-flag clippers also sailed in this trade under charter. Between 1852 and 1859 sixty-six non-British vessels, mostly American, departed for Oceania from British ports carrying 15,432 persons.[41]

All of these demands greatly contributed to the tightness in the freight market at this time. There was also a strong demand because of very active business generally, the existence of food shortages in England and Ireland, and the extensive chartering of vessels for service as troop transports and supply ships by the British government during the Crimean War. Altogether the result was an unprecedented demand for large-sized, deep-sea tonnage during the first three-fourths of the decade of the 'fifties.

5

There was also intensive activity in the whaling industry and coastwise carrying trade. The former experienced a rising demand until the drilling of "Drake's Folly" at Titusville in 1859 brought in petroleum. From a position of relative unimportance among the maritime industries it rose rapidly until by 1845 the 190,696 registered tons employed were equal to 21 per cent of the registered merchant tonnage of the nation. This expansion was conducted, however, in the face of sharply increasing costs because of the exhaustion of the old whaling grounds, the resulting need for longer voyages to new grounds, and the increased time required in cruising on the grounds. From a small-scale coastwise fishery in the North Atlantic in the eighteenth century, the scope of the American whaling industry was extended in succession to the

[41] *Report of the* [British] *Select Committee on Merchant Shipping* (1860), Parliamentary Papers, 1860, XIII, 776.

ancient Greenland grounds about 1760; to the Brazil Banks, which lie in the South Atlantic below the Tropic of Capricorn and were first visited by the Nantucket brig *Amazon* in 1774; to the South Pacific grounds beyond Cape Horn, to which at least six ships had been by 1791; to the rich off-shore grounds well west of the Peruvian coast, which were opened about 1818; to the fishery in the Gulf of Alaska, which was first fished by the *Ganges* of Nantucket in 1835; to the cold Kamchatka field off the coast of Siberia, which was first discovered in 1843; and finally to the dangerous bowhead whale fishery of Behring Sea, which was opened by the *Superior* of Sag Harbor in 1848 and became the final resort of the American whalemen.[42] The voyages to these new grounds now lasted from three to four years and required larger and more sturdy vessels than the small brigs, schooners and sloops of the earlier period. Consequently the typical whalemen of this period was the stout live-oak short-rigged ship or bark from 300 to 500 tons.[43] The fleet documented in the whale fishery, most of which was under register, rose sharply from 39,705 tons in 1830 to 190,903 in 1845, after which little change occurred. The peak for the century was achieved in 1858, when 198,594 tons were documented.[44] Thus the heyday of whaling was reached during this period. The business of building whaleships was, therefore, very active, especially during the period of most rapid growth. Numerous old packets were also sold into this trade after they had become obsolete in the Atlantic trade. The American whaleman, which was built at low cost and was manned with cheap labor from the Portuguese Islands, was at this time the world's chief whale hunter, it being said that in 1842 of the world's 882 sail 652 were American.[45] The whaling business thus contributed to the already huge boom in shipbuilding both by demanding the construction of many large whalers and by providing a market in which old merchant tonnage could be readily sold to make room for new.

The coastwise shipping industry continued its steady growth under the stimulus of the rising cotton traffic, of the developing

[42] Marvin, pp. 134–146.

[43] Alexander Starbuck, *History of the American Whale Fishery to 1876* (1878); see particularly the table of vessels and voyages, 1784–1876, pp. 180–659.

[44] A.R.C.N., 1914, pp. 186–188.

[45] Marvin, p. 146; C. M. Scammon, *The Marine Mammals of the Northwest Coast of North America and the American Whale Fishery* (1874), p. 212.

trade in manufactures generally, and of the expanding movements of bulk cargoes, such as coal and lumber, which were beginning to become significant. The total fleet, which consisted of vessels of diverse types — square-rigged ships, brigs, coasting schooners, steamships and steamboats, canal boats, and barges — and included vessels located on the Great Lakes and western rivers as well as on the seaboard, rose from 516,979 tons in 1830 to 1,176,694 tons in 1840, to 1,797,825 tons in 1850, and to 2,644,867 tons in 1860. The total coastwise tonnage was approximately equal to that in the foreign trade in 1830, but the growth in the coastwise trades was much more rapid until the late 'forties and 'fifties, when the sharp expansion in the foreign carrying trades again brought the size of the fleet in that business close to that of the coastwise fleet. In 1856, in fact, the registered tonnage actually exceeded the enrolled and licensed tonnage. After the boom, however, the rise of the coastwise fleet continued while the growth of the fleet in foreign trade was checked.

The portion of the coastwise tonnage which consisted of seagoing vessels was only a small part of the total. Large ships and barks were employed in the long-voyage carrying trades from the northern ports around Cape Hatteras to the South. Some of these were operated in packet lines resembling those on the European run. Supported by large general cargoes southbound and by cotton shipments northbound and protected from foreign competition by the navigation monopoly, these vessels stood at the head of the coastwise marine. Lines operating full-rigged ships on regular schedules from New York were started to Charleston by Messrs. Barker, Hopkins, and Mauran in 1822, to Savannah in 1824, to New Orleans in succession by John W. Russell in 1821, Silas Holmes in 1824, and E. K. Collins in 1831, and to Mobile by E. D. Hurlburt, whose ships ran irregularly from 1825 to 1830, and regularly thereafter.[46] By 1830, there were thirty-two coastwise packets in service, a figure which remained nearly constant.[47] In addition a large number of regular traders sailed to the South from New York, Boston, and other ports. In this portion of the coastwise trade the largest and best vessels were employed.

The short-voyage coastwise trade of the New England and Middle-Atlantic States also felt the effects of expansion. In part

[46] Albion, *Square-Riggers on Schedule*, pp. 53–61.
[47] Albion, *Square-Riggers on Schedule*, p. 274.

this traffic was caused by the growing demand of the rising centers of population for foodstuffs, for such building materials as lumber, lime, brick, and stone, and for coal and firewood, by the growing interregional traffic in manufactured articles, such as textiles, shoes, and ironware, and by the rise of national markets for primary produce of all kinds. The relatively self-sufficing regional economy of the former period was changing to one embodying a large-scale interchange of commodities. The coastwise fleet, which was composed mainly of schooners, provided much of the transportation service along the eastern seaboard for this traffic. It also provided the means whereby the traffic to and from the interior flowing through the ports with deep hinterlands, notably New York, was collected and distributed along the seaboard. Although now supplemented by the railroad in many places, the costs of shipping by sea were still so relatively low that the railroad was, in effect, merely a means of extending the maritime arteries inland in many cases. It can be said, therefore, that the coasting schooner or brig was a vital element of the American economy at this time.

6

During the three decades from 1830 to 1860 shipping activity as a whole in the United States rose to hitherto unprecedented heights. The total tonnage of all kinds documented increased five-fold from 1,191,776 gross tons in 1830 to a high of 5,539,813 gross tons in 1861, a figure which was not surpassed until 1902.

Accompanying this rise were other important changes. The development of a larger volume of traffic and the greater concentration of freight in the rising primary transshipment centers, New York, Boston, Philadelphia, Baltimore, and New Orleans, produced a separation between the functions of transportation and trading. This separation was not fully completed, however, until after the Civil War. The change was stimulated by the rise in the important carrying trades of a demand for much larger and more powerful vessels than could formerly be readily filled with cargo. These vessels were more economical carriers, ton for ton, than the smaller vessels of the earlier period. They were also, in general, too large to be employed effectively in private trading, and hence such operations tended to diminish. The degree of

specialization was thus increased. A further influence tending to eliminate the private trading ship was the greater degree of order brought into commerce by the railroad, telegraph, and mail steamship and by the establishment of western business houses in many ports of the Far East. The advantages which maritime merchants formerly secured through the direct contacts and private channels of information resulting from the ownership of vessels became much less important. Hence many wholesalers, importers, and exporters now found it preferable to use the frequently sailing common carriers or to charter entire vessels as necessary. Competition between shipowners in the primary trades was very keen, and shippers now rarely found difficulty in securing tonnage at favorable rates.

The economies of large-scale operations in shipping were still few, however, and hence large firms and combines such as later appeared did not develop. The single-ship enterprise, often owned by the shipmaster or by a family, was still common. Firms owning over ten vessels, while not unknown, were quite rare. Thus the characteristic type of enterprise during this period of expansion was the small firm operating one or several sailing tramp ships, and its primary function was the provision of transportation service.

The expansion of the shipping industry was reflected in a boom of the shipbuilding industry in the United States, which reached extraordinary proportions between 1847 and 1857, and which marked the peak in the construction of wooden ships. It was accompanied by a trebling in the size of the ocean-going vessels built, a notable advance in models, rigs, and techniques of construction, and by sharply increasing costs of construction because of timber and labor difficulties. Activity was mainly centered in the construction of ships and barks, many of them over 1000 tons in size, which were now the primary units of the ocean-going marine. There were 1480 such vessels built during the sixteen years 1831–1846, and 2858 during the eleven boom years 1847–1857. The output of these vessels may be estimated to have increased from an annual average of about 17,000 gross tons for the years 1815–1830 to one of about 210,000 gross tons for the years 1847–1858 — an expansion of about twelve hundred per cent. In contrast, the output of the smaller vessels, which were used primarily in the coastwise and short-voyage foreign trades

showed only a moderate increase. The expansion of the shipbuilding industry is summarized in the accompanying table.

The fluctuations in activity, which were more and more to become a feature of shipbuilding, became more pronounced during this period. In general, fluctuations in the state of trade were magnified, for in times of slack business the marginal vessels, which were generally the oldest, were laid up, and fewer replacements were made, while in boom times owners hastened both to

AVERAGE ANNUAL OUTPUT OF SAILING VESSELS IN THE UNITED STATES, BY SELECTED PERIODS [48]

Fiscal Years	*No. of ships and barks*	*No. of brigs*	*No. of schooners*	*No. of sloops and barges*	*Total tonnage*
1815–30	57	120	450	220	88,200
1831–46	93	100	412	206	99,700
1847–57	259	113	610	372	308,000
1858–78	83	30	422	417	196,000

replace old and unserviceable craft and to add new ships to their fleets. Thus an examination of the record for the years 1831–1846 shows a sharp rise from a low level of 58,560 gross tons in the depression year 1830 to a high point of 161,492 gross tons in 1833, mainly because of unprecedented activity in the North Atlantic and cotton-carrying trades and of the expansion of the whaling industry. The average output was 116,000 gross tons during the period 1831–1834. This rise was followed by a moderate recession during the years 1835–1838, the average output falling to 85,000 gross tons. Then there was moderate revival during the years 1839–1846, the average output rising somewhat to 98,500 tons. As might be expected, the fluctuations were most severe in the production of ships and barks for the deep-sea trades. It may be seen, therefore, that on the whole little progress was made between 1830 and 1846 so far as volume was concerned.

The big boom began in 1847 as a result of high business activity, the Irish famine, the repeal of the British corn laws in 1846, which action opened up a vast demand for tonnage to lift North American grain, and the expansion of the cotton trade. On top of this demand were superimposed the intense demand for California and China clippers during the early 'fifties, and,

[48] Compiled from A.R.C.N., 1914, pp. 194–195.

beginning on a large scale in 1854 following the revision of Lloyd's rules, the demand of the English shipowners, who for the first time since the Revolution, were able to buy freely in the United States. Shipbuilding capacity consequently was severely strained. The total tonnage built rose to a very high peak of 583,450 gross tons in 1855, after which output tapered off. The number of ships and barks built rose from an average of ninety-six for the years 1839–1846 to 254 in 1848, 198 in 1849, 247 in 1850, 211 in 1851, 255 in 1852, 270 in 1853, 334 in 1854, and an all-time record of 381 in 1855, after which there was a decline to 306 in 1856, 251 in 1857, 122 in 1858, and eighty-nine in 1859.[49] During this period, the United States became easily the unrivaled shipbuilding nation of the world.

This period of active shipbuilding brought about important changes in the economic position of the industry. In general, rising costs of construction prevailed, which partly eliminated the competitive advantage of the American yards. The elasticity of supply in some regions, notably Maine, was, however, much greater than in others. There was, in consequence, considerable relocalization. Many builders were faced after 1840 with serious difficulties in securing the heavy timber required for the new, large vessels, and were forced to tap the supplies of the more inaccessible parts of the coastal plain, the Great Lakes, and the South. There was also a scarcity of skilled labor, which resulted in rising labor costs. The resources of the country were thus severely strained by the boom.

The industry was still basically a highly-competitive, handicraft one in which few economies of large-scale operations developed. The expansion took place, therefore, primarily through an increase in the number of yards. In nearly every town whose waterway could float a large ship the construction of freighters or clippers was undertaken. In some of these no such large vessels had been built before. The older and better-known yards were expanded until they could handle as many as four to six ships, with aggregate sales values of $400,000 to $800,000, at once. The latter figure represents about the maximum size attainable by firms of this period without incurring serious diseconomies. In the larger ship-

[49] A.R.C.N., 1914, pp. 194–195. The years are the fiscal years ending Sept. 30 from 1835 to 1842, and ending June 30 beginning in 1843. The average for 1839–1846 is therefore slightly low.

building centers the number of yards multiplied as foremen, journeymen, and even apprentices who could secure a little capital set up establishments and began construction, sometimes on order, but more often on speculation, a practice which later ruined many. In the Port of New York in 1855 there were listed thirty-one shipbuilding establishments employing 2313 hands.[50] In the Port of Boston in the same year there were nineteen yards alone working on full-rigged ships, besides many others engaged in other types of work.[51] There were also engaged in building such vessels between 1848 and 1857 fourteen yards at Thomaston, six at Rockland, seven at South Thomaston, seventeen at Waldoboro, twelve at Kennebunkport, and ten at Freeport, which towns were typical of the smaller centers. Because of the greater size of the vessels and the growing importance of ocean-borne timber supplies, the shipbuilding industry declined, however, at many of the up-stream centers where it had formerly been active. For instance, it almost disappeared on the upper reaches of the Kennebec and Sheepscot, on the upper St. George at Warren, on the Piscataqua at Dover, Durham, and Berwick, on the Merrimack at Haverhill and Amesbury, on the North River, and on the Connecticut at Middletown, Haddam, and Essex. The effect of the boom was, however, to open many more yards than it closed, and to sweep into the industry a great mass of master carpenters, many of whom were poorly prepared.

7

The supply of ship timber naturally became the leading problem during this period because of the growing scarcity and the increased demand for lumber in general, and especially for the large sizes which were needed in the larger merchant vessels. Ship timber, which had been practically ubiquitous in 1800 and was still readily obtainable locally at most ports in 1830, was by 1860 a clearly localized material obtainable only with some difficulty and at much higher prices. In Maine and New Hampshire

[50] Albion, *The Rise of New York Port*, p. 300.

[51] "Report on Shipbuilding in Boston," *R.B.B.T.*, 1856, pp. 61–62. These builders were Donald McKay, Paul Curtis, R. E. Jackson, Samuel Hall, G. & T. Boole, Pratt & Osgood, D. D. Kelley, Hugh McKay, A. & G. Sampson, and Joseph Burke at East Boston; Hayden & Cudworth, J. O. Curtis, J. F. Foster, and S. Lapham at Medford; John Taylor and J. Stetson at Chelsea; J. Magoun at Charlestown; E. & H. O. Briggs at South Boston; and George Thomas at Quincy.

it was still possible to secure white oak for frames, good knees, and pine spars, although it was usually necessary to go some distance from tidewater. Builders elsewhere relied on white oak brought from the newly tapped forests of the Great Lakes to New York by lake schooner and barge, and thence by schooner coastwise, and from the interior forests of Maryland and Virginia, where there were large stocks. More and more coasting schooners were to be found at the yards unloading cargoes of material originating at a distance. Timber stores were consequently established by enterprising merchants at the leading ports. One of these was maintained at Boston, beginning in 1834, by the East Boston Timber Company, which owned its own timber limits on the Niagara River.[52] It shipped some of its material pre-cut to molds supplied by the builders. Oak knees, now scarce, were displaced by hackmatack ones which were secured in the deep forests of northern Maine and Canada. Southern hard pine planking, which was cut in Georgia and the Carolinas, also came into general use during this period, supplanting oak. Some other effects of the shortage were the increased use of inferior woods such as birch, maple, and chestnut in vessels, especially in those built on speculation, the growing difficulty in securing certain shapes, and the inclusion of an increased amount of sapwood in timbers. Live oak became much less popular at this time because of its great weight and high price. The masts and spars were still generally of northern white pine, but toward the end of the period southern pine was sometimes substituted, for the pine forests now contained few great mast trees.

The United States had thus reached a stage, similar to that of Europe a century earlier, in which the remaining reserves of shipbuilding material were rapidly being depleted. The older northern seaboard states, where the shipbuilding industry was centered, were by 1860, with the exception of Maine and the interior of New Hampshire, seriously despoiled of their large virgin white oak and white pine stands, and in many places the land had been cleared. Private forest operations proved to be particularly exhausting, for in an effort to secure a maximum immediate return on the investment owners undertook wholesale slashing, sent the largest trees to the mill along with the rest, frequently caused disastrous fires by leaving the dried branches

[52] Sumner, pp. 671–672.

on the ground, and normally failed to provide for replanting. Competition reduced the price of timber to a level not far above that of the direct costs of cutting, hauling, and milling. The experience of both Europe and the United States showed that in the case of large timber requiring from seventy-five to one hundred and fifty years to mature a price far above that ordinarily produced in a free competitive market was necessary to induce private owners to plant and wait for maturity, because of the time factor, the capital costs, and the risks involved. Hence as the first growth was cut off the supply of large-sized timber rapidly diminished, for owners rarely allowed new stock to reach full development before cutting. Ship timber was, in fact, ruthlessly wasted in the United States, and hence the entire maritime position of the country depended on the temporary advantage which was secured while the virgin timber was being cut and sold. This was a matter of the utmost seriousness, for the rapid slashing of the virgin ship timber threatened to bring American prices up to a par with those of western Europe within three or four decades. For instance, in New York the prices of various frame timbers rose between 29 and 42 per cent between the 'forties and 1854.[53] Increased costs of ocean transportation were threatened, therefore, in the near future, for until the 'fifties the suitability of iron as a material was not generally appreciated. This then was the unstable situation which existed when the great boom expanded the output of ships.

Nevertheless, the country remained surprisingly indifferent to this situation, despite the strong warnings of such noted foresters as Michaux, J. D. Brown, and G. B. Emerson.[54] No adequate conservation policy was undertaken, either by the states or the Federal government until the fourth quarter of the century, except in the case of live oak, but even then enforcement was difficult.[55] In the north central states, notably Michigan, Wisconsin, and Minnesota, the large tracts of forest land were sold by the government and rapidly cleared by lumbering concerns. Forest conservation did not in fact begin on a substantial scale until long after the wooden ship had ceased to be a factor of importance in marine transportation. The boom in shipbuilding

[53] J. H. Morrison, *New York Shipyards*, p. 153.
[54] John Ise, *The United States Forest Policy* (1920), pp. 26–29.
[55] Cameron, pp. 81–88.

of the late 'forties and 'fifties therefore left the forests containing ship timber in a seriously depleted condition.

The cost of labor also rose sharply at this time, especially in the city yards, as a result of the shortage of skilled workmen, the general high activity in business, the westward migration, and the formation of labor organizations. Although no adequate data are available, it appears that the wages of ship carpenters, which during the mid-'forties ranged roughly between \$1.00 and \$1.50 per day in the eastern rural areas, and between \$1.75 and \$2.00 in the city yards, rose to between \$1.75 and \$3.50 in the former, and to between \$2.00 and \$4.00 in the latter, during the 'fifties. There were wide variations in the rates between yards, and especially between towns, because of the immobility of labor, the personal relationships of the masters and workmen, the varying degrees of scarcity of labor, the differences in the skills required on different types of craft, and variations in the perquisites allowed. Hence generalization in this matter is difficult.[56] The number of shipyard workers employed reached a peak during the 'fifties, there being in 1855 about 2300 workers at New York, 1500 at Boston, 650 in and around Newburyport, 3500 in the entire state of Massachusetts,[57] and perhaps about 1500 each in such Maine centers as Portland, Waldoboro, and Bath. In some cases, great difficulty was experienced in securing capable men, and it was therefore necessary to train many men and boys. In New York, labor, which had been organized since about 1830, was able to secure an improved position, the chief achievements being a nine-hour day and somewhat higher wages than prevailed elsewhere. Since the direct labor costs amounted to between a half and a third of the cost of the bare hull and spars at this

[56] According to J. H. Morrison, *New York Shipyards*, pp. 153–154, wages at New York rose from \$2.00 in the 'forties to as high as \$3.00 in the 'fifties. The Boston Board of Trade Report for 1856, pp. 5–6, gives Boston wages for that year as \$3.00, and those at New York at \$2.50. Samuel Hall, a leading Boston builder, reported that he paid the carpenters working on the clipper ship, *Surprise*, 1261 tons, built in 1850, \$1.75 per day, and that between 1850 and 1860 rates of pay in his yard varied between \$1.50 and \$2.00 per day. See Lynch Report, p. 85. In Maine the peak appears to have been \$3.50. See statement of N. G. Hichborn, Lynch Report, p. 18. Other reports are as follows: Damariscotta, 1854, \$3.00; 1857, \$1.50–\$1.75; Eastport, 1854–1860, \$1.75; York, 1854, \$2.00; Portsmouth, 1854–1860, \$2.00; Bath district, 1854, \$3.25. See Lynch Report, pp. 196, 212.

[57] *Abstract of the Census of Massachusetts*, 1855, Boston, the Secretary of State, p. 167.

time, this increase was a matter of considerable significance for the prosperity of the New York builders.

Some conception of the items of expense involved in the construction of a deep-sea merchant ship at this time may be obtained from the accompanying accounts of the ship *Harvest*, a medium-sized vessel of 646 tons, which was built in the moderately low-cost center of Kennebunkport in 1857.

The effect of the boom under these supply conditions was to

EXPENSES OF BUILDING THE SHIP *Harvest*, 646 TONS [58]

Item	*Amount*	*Item*	*Amount*
4245 days' work	$6395	Pine deck plank	$ 747
Contract work [a]	2196	Spars	654
Supervision and general expense [b]	1286	Misc. lumber [c]	519
Oak timber	4211	Iron fastenings, nails, and castings	1963
Hackmatack knees	403	Oakum and paint, etc.	1652
Southern pine plank	3389	Equipment	643
Oak plank	812	Tools	131

Total cost, hull and spars only, $25,001.

[a] Consisted of manual labor, $1684; millwork, $375; hauling, $148.

[b] Consisted of officers' expense and fees, $895; insurance, $217; rent, $130; interest, $34; storage, $10.

[c] Consisted of pine for cabin, $312; uprights, $68; staging, $43; molds, $32; pine timber, $54; walnut, $9.

raise the prices and costs of construction of American-built vessels substantially. The prices rose more than the costs, however, and hence shipbuilding was very profitable. It is, of course, extremely difficult to secure adequate price data because of the paucity of accounts, their lack of uniformity, and the varying degrees of quality in construction, finish, and outfit among vessels. In general, the prices of first-class, two-deck clippers and packets built in the noted New York and Boston yards were very high during the early 'fifties, ranging between about $55 and $100 per ton, ready for sea except for stores.[59] Large, well-built freighters cost somewhat less, the range being roughly between $45 and $70 per ton. In general, the eastern yards could build vessels at lower

[58] Accounts and Papers of the Kennebunkport Shipbuilding Company, MS., Graves Memorial Library, Kennebunkport, Maine.

[59] O. T. Howe and F. C. Matthews, *American Clipper Ships, 1838–1858*, 2 vols. (1927), give the following figures of the costs of certain selected clipper ships. The basis of computation is somewhat uncertain, however, as it is not clear what outfits, if any, are included, and whether the builder's profit or loss is added in. The diffi-

prices per gross ton than those of New York, approximate figures for the mid-'fifties being New York, \$60–70; Boston, \$55–65; Portsmouth, \$50–60;[60] Maine, \$45–65; and New Brunswick, Canada, a rising shipbuilding center, \$40–50.[61] It is evident from these meager figures that the prices of vessels, especially those of high quality, were considerably higher than at earlier periods.

8

The northeastern yards, especially those in Maine, proved to have the greater elasticity of supply during this boom because, on one hand, of the fact that the majority of the builders could still secure white oak frame timber, knees, and spars locally, although this was done only with increasing difficulty, and on

culty in securing information about costs is great, for most builders kept few if any accounts.

Ship	*Year*	*Tons*	*Cost per ton*	*Yard*
Oriental	1849	1003	70	Brown & Bell, N. Y.
Challenge	1850	2006	75[a]	W. H. Webb, N. Y.
White Squall	1850	1119	80	J. Bell, N. Y.
Invincible	1851	1769	67	W. H. Webb, N. Y.
Contest	1852	1098	73	J. Westervelt, N. Y.
Young America	1853	1961	71	W. H. Webb, N. Y.
Sunny South	1854	776	90	G. Steers, N. Y.
Telegraph	1851	1078	65	P. Curtis, Boston
Reporter	1853	1474	55	P. Curtis, Boston
Aurora	1853	1396	60	J. Taylor, Boston
Asterion	1854	1135	59	J. Stetson, Boston
Witch-of-the-Wave	1851	1498	53	G. Raynes, Portsmouth
Morning Light	1853	1713	68	Tobey & Littlefield, Portsmouth
Snow Squall	1851	742	41	A. Butler, Portland

[a] Includes stores for a year's voyage.

60 *Rockingham Messenger*, Portsmouth, N. H., February 16, 1853. The paper states: "We have made particular inquiry of builders, and they state that the proper sum, as a general average, to be about \$55 per ton. In some cases, they have built much below that price — in no case have they built up to \$60." Neal, Matthews and Brooks of Kittery, builders, give the cost for the year 1854–1860 as \$58 per ton. See Lynch Report, p. 195. The Collector of Customs reports the cost as about \$60 per ton. See Lynch Report, 212. The *Rockingham Messenger* states that the Portsmouth builders believed that comparable vessels cost about \$62 per ton at Boston and New York, \$50 per ton in Maine, and \$45 in New Brunswick.

61 Statements made by shipbuilders in the Lynch Report for various ports are as follows: Eastport, 1854–1860, \$50 per ton (p. 196); Damariscotta, actual costs, ship of 750 tons, built 1854, \$65 per ton; ship of 1200 tons, built 1857, \$52 per ton (p. 197); Kennebec River, 1854–1860, A–1 ship of 1000 tons, \$50–\$55 per ton (p. 212).

the other hand, of the fact that the labor supply, which was to a considerable extent engaged in agriculture as well, was more immobile and more elastic than that in New York, Boston, and other more western centers. Labor in these centers was affected by the westward migration, the rise of manufacturing, and unionization. Maine, which could build freighting vessels at from $5 to $15 per ton less than New York, two-thirds of which difference may probably be attributed to labor costs, consequently rose to be the primary center of the construction of deep-sea ships. The accompanying table clearly shows this development.

NUMBER OF FULL-RIGGED SHIPS AND BARKS BUILT IN THE PRINCIPAL SHIPBUILDING STATES IN CERTAIN SELECTED YEARS [62]

State	*1830*	*1834*	*1840*	*1845*	*1850*	*1855*
Maine	3	32	50	43	127	213
New Hampshire	2	5	4	4	8	8
Massachusetts	8	33	25	42	51	70
Rhode Island	0	3	2	3	5	9
Connecticut	1	0	0	1	3	5
New York (seaboard)	5	16	6	18	26	40
Pennsylvania (seaboard)	2	2	6	6	7	10
Maryland	2	3	3	4	16	14

During the entire eight years from 1850 to 1857, Maine yards supplied 1150, or slightly over one half, of the 2255 ships and barks built. In the construction of brigs, schooners, and other smaller craft, they also maintained a leading position. The District of Bath, which included the entire length of the magnificent Kennebec River, became the leading shipbuilding center of the nation during the 'fifties, completing during each of three consecutive years the extraordinary number of 56 full-rigged ships and barks. In the city of Bath alone, 181 ships, 18 barks, 11 brigs, 2 schooners, 6 sloops, and 4 barges, with a total tonnage of 181,479, were built during the years 1851–1860.[63] Other outstanding centers were the District of Waldoboro, which included Thomaston, and the District of Portland, which included the shipbuilding towns of Yarmouth, Freeport, Brunswick, and Harps-

[63] Compiled from the R.C.N.T. for the years given. The year 1834 was chosen instead of 1835 because in the latter year the fiscal year, on which the returns are based was altered, ending on June 30 instead of on September 30, and hence the return covers nine months only.

[63] H. W. Owen, p. 479.

well. Of Thomaston in 1853 an observer wrote that "the shipyards along the shore presented a scene of great activity, some seven or eight first-class ships being in process of building, none of them less than 1100 tons." [64] In the districts of Passamaquoddy, Machias, Frenchman's Bay, Bangor, Penobscot, and Wiscasset, where full-rigged vessels had rarely been built before 1850, large numbers of such vessels were also laid down. Of the total Maine output of these units in 1855, there came from Bath 56, Waldoboro 46, Portland 31, Passamaquoddy 22, Belfast 13, Bangor and Penobscot combined 13, Wiscasset 11, Kennebunkport 7, Machias 7, and Frenchman's Bay 5.[65] Many of these vessels came from newly established yards. The construction of freighters, chiefly cotton ships, on speculation, first for the New York and Boston markets, and later for those of Great Britain,[66] was the principal business of these numerous establishments.

Much of the tonnage built in the New York and Boston yards at this time consisted of high-class vessels, especially clipper and packet ships, in which high speed and superiority in model, construction, and finish were desirable characteristics. The New York and Boston builders were the leaders in naval architecture at this time, and in addition had at their command highly-skilled labor and excellent equipment. A number of builders, by pioneering in design and construction, achieved national and international reputations as masters of their craft, and were thus able to secure lucrative contracts for high-class vessels. Among the most noted of these may be mentioned William H. Webb, who, beginning his career in 1836, achieved perhaps the largest total tonnage of any American shipbuilder of this age. He constructed a list of vessels which included the leading Atlantic packets, clippers, and ocean steamships of the time. Jacob Westervelt, Brown & Bell, and Smith & Dimon of New York, and Donald McKay, perhaps the most outstanding clipper-ship builder, and Samuel Hall of Boston were also among the foremost in their profession. In both ports there were a large number of other firms with excellent reputations. In Newburyport were the firms of John Currier and Cur-

[64] Eaton, *History of Thomaston*, I, 427.

[65] R.C.N.T., 1855. The construction in Maine may be understated in the return because of the departure of new vessels for Boston and New York under carpenter's certificates.

[66] Statement of N. G. Hichborn, President of Maine Shipowners' Association, Lynch Report, p. 17.

rier & Townsend, and at Portsmouth those of George Raynes, Tobey & Littlefield, and Fernald & Pettigrew, all of which built high-grade vessels. In these four centers most of the superior ships were built.

Most of the clippers and packets were, in fact, built south of the Piscataqua. Although it is difficult to distinguish between clippers and ordinary merchantmen, it is significant that of the 114 extreme vessels listed by Captain Clark only sixteen came from Maine yards.[67] A considerable number were, however, built at Portsmouth and Newburyport, generally for New York and Boston accounts. Of the Atlantic packets, New York was easily the leading producer, 139 of the 186 vessels built for that port's transatlantic services between 1818 and 1868 having been built within its confines.[68] Also 78 out of the 119 New York coastwise packets sailing to the South were also built there. The packets of the Boston transatlantic services were likewise mainly built at Boston, those for the first Liverpool Line by Thatcher Magoun, and those for Train's Line by Donald McKay. Occasionally after 1848 vessels of this type were, however, also built in Maine and New Hampshire, the total for the former being eight, and for the latter four.[69] The New York and Boston yards were, therefore, without doubt the leaders in naval architecture, and to the yards in these places the shipbuilders of the smaller centers came frequently to canvass the improvements in shape and construction.[70] J. W. Griffiths, the leading naval architect of the period, wrote with pardonable local pride in 1851 that New York shipbuilding was "the standard for nearly all parts of the commercial world," and that builders and owners, both at home and abroad, sought models and information on construction from the yards there.[71]

In contrast, the Maine yards concentrated on the construction of large sturdy freighters, which were built to sell at low prices and to carry cargoes cheaply. Consequently, beginning in the early 'forties, much tonnage of this type was built in Maine for New York and Boston accounts, both on order and on speculation, for in this class of business the city yards were at a disadvantage.

[67] A. H. Clark, Appendix I.

[68] Albion, *Square-Riggers on Schedule*, p. 86.

[69] Albion, *Square-Riggers on Schedule*, p. 86.

[70] Griffiths, *Treatise*, p. 305.

[71] Griffiths, *Treatise*, p. 305.

The localization of the shipping industry in the United States was further altered in favor of New York and Boston during this period as a result of the increased tendency of foreign trade to flow through these centers. Hence the ship markets in these ports, to which Maine-built vessels were sent, increased notably in size and activity. The entries of American vessels from foreign ports rose from 374,602 tons in 1834 to 1,377,738 tons in 1855 at New York and from 158,712 tons to 373,626 tons between the same years at Boston, whereas those at Philadelphia and Baltimore increased only moderately, those at Salem and Portland but slightly, and those of Bath and Portland declined.[72] The permanently registered tonnage consequently tended to some extent

REGISTERED TONNAGE, TONNAGE ENTERED IN FOREIGN TRADE, AND NUMBER OF FULL-RIGGED SHIPS AND BARKS BUILT AT CERTAIN SELECTED PORTS[73]

Customs district	*Permanently registered tonnage*		*American tonnage entered*	*No. of ships and barks built*
	1834	*1855*	*1855*	*1855*
New York	135,324	566,613	1,377,738	40
Boston	93,457	393,577	373,626	49
Philadelphia	57,487	47,739	152,822	10
Baltimore	55,640	77,107	121,337	14
Salem	29,729	18,337	14,659	..
Portsmouth, N. H.	17,598	18,680	2,436	8
Bath	15,476	129,262	4,423	56
Portland	30,916	82,895	37,577	31

to be concentrated in the large, active ports, thus reflecting the tendency of the localization of shipowning to follow that of commercial centers. Some Maine ports, particularly Bath, showed, however, a tendency to develop a volume of registered tonnage much greater than that which their own foreign trade warranted. Thus the Maine ports, and to a less extent those of Massachusetts and New Hampshire, by virtue of their lower costs of capital, entrepreneurial talent, and labor, and the close connection which was developing between shipping and shipbuilding, continued to serve as carriers for other centers when their own commerce died — a role which was later to increase in importance. These relationships for a few ports are indicated by the accompanying table.

[72] Compiled from R.C.N.T., 1834, 1855.
[73] Compiled from R.C.N.T., 1834, 1855.

It is clear from these figures that local self-sufficiency was still further broken down during this period. More and more vessels hailing from the eastern maritime centers engaged in the carrying trades of the rising seaports of New York, Boston, Philadelphia, and Baltimore. The latter centers were clearly unable to increase their tonnage in proportion to the growth of their traffic. They were even less able to build themselves all of the new ships which they needed. These changes were the result of alterations in regional planes of living and in the distribution of economic opportunities, and, in the case of shipbuilding, of the depletion of regional timber resources.

CHAPTER X

TECHNICAL LEADERSHIP, FREE NAVIGATION, AND THE INTERNATIONAL POSITION OF THE AMERICAN SHIPPING INDUSTRY, 1830–1862

I

DURING THE PERIOD from the Revolution to the Civil War the basic competitive position of the American shipping and shipbuilding industries was continually deteriorating because of the pressure which was steadily narrowing the favorable differential in construction costs. The decade of the 'fifties proved, in fact, to be the critical one, for in the early 'sixties the period of competitive advantage in the great ocean carrying trades was definitely closed. Under more stable economic conditions, the rise in material and labor costs might have been expected to bring about a slow deterioration in the position of American owners, but, instead, a number of factors caused the postponement of large-scale change until the close of the decade, when the great deluge began.

One of these factors, which was of great importance, was the development in the United States for the time being of a position of notable leadership in the design and construction of wooden sailing ships. It was this superiority in the design of certain types of American ships which, in conjunction with the boom in the California trade, brought American shipping to the forefront in international competition and gave it the great prestige which still lingers in the old seaports.

The position of technical leadership was created primarily by the genius and ability of a limited number of builders and designers, among whom may be mentioned J. W. Griffiths, the designer of the celebrated clipper ship *Rainbow*, George Steers, Samuel Pook, William H. Webb, Donald McKay, and Samuel Hall. Naval architecture, as generally practiced in the United States, was at this time highly unscientific, the majority of builders merely laying down vessels from models which they

shaped by eye to more or less standard forms.[1] Few were capable draftsmen, and still fewer possessed any scientific knowledge of mathematics, physics, hydraulics, and applied mechanics. Only two major treatises, those of Lauchlan McKay and J. W. Griffiths appeared. Ship modeling was thus more of an art than a science, but the expansion in the shipbuilding industry, the premium prices paid for fast vessels, the practical experience of the builders, and the technical ability of a small number of gifted naval architects nevertheless enabled the American shipyards temporarily to achieve international reputations as builders of large, fast, strong, and weatherly ships. Once the new models had been produced and proved, the rank and file of builders everywhere went to New York and Boston to inspect them. A surprising number, indeed, soon succeeded in more or less successfully duplicating these models or in adapting them to their needs.

Such a system was suitable, however, only for the business of building wooden sailing ships. After the Civil War, when naval architecture had become more scientific, it was necessary to send men to England, France, and Germany for study, suitable training not being available in the United States until 1894, when the Webb Institute, which was founded in 1889 by W. H. Webb at New York, began to admit students.[2] For the time being, however, a large number of American master carpenters occupied a foremost position in the arts of designing and building fine sailing ships.

The changing nature of the shipowners' demands during this period was probably responsible for much of the improvement in design. Prior to 1830 the shipbuilders had constructed mainly small craft, as we have seen. Many of these had been built for the accounts of maritime merchants, most of whom desired carrying capacity rather than speed, except in the case of privateers. Hence, although American ships were generally well built, durable, and cheap, they were undistinguished in model, finish, and rig as a group. With the exception of the small Baltimore-clipper brigs and schooners, which were not very useful in ordinary navigation, few vessels of notable design were constructed. The de-

[1] Griffiths, *Treatise*, p. 34; L. McKay, p. vii.

[2] George Rock, "The Education of Naval Architects," *Trans., S.N.A. & M.E.*, XL (1932), 196.

velopment of ocean commerce, however, and especially the rise of the immigrant, cotton, and California trades on one hand and the growing separation between the transportation and the mercantile functions on the other, soon forced owners to demand larger, faster-sailing, and better-built vessels in order to secure premium freight rates in the highly competitive freight markets which were arising. Hence by 1850 American yards were constructing vessels of a size and finish comparable to those of the best European-built ships, and in model and rig they were generally superior. This development was greatly stimulated by the intense competition which arose among owners, builders, and masters in almost all branches of the carrying trade. This was especially true in the California trade, in which the sailing records of the rival ships were carefully kept and widely publicized. Bets and challenges were freely made, and more or less formal races were not uncommon. Under these stimulating conditions builders had every incentive in both money and prestige to put forth their best efforts and to be daring in design.

The tonnage of the common cargo carriers increased about threefold between the 'twenties and 'fifties. It should be noted, however, that the registered tonnage of vessels, because of the manner of its computation, was but an imperfect measure of size and carrying capacity. In 1841, when the cotton ship *Rappahannock*, 1133 gross tons, was built by Clark & Sewall at Bath, a cargo ship of 1000 tons was considered to be a monster. By 1855, however, many vessels of 1500 gross tons or more were afloat. The typical deep-sea freighter of the 'fifties registered about 1000 gross tons. Some figures showing the increase in size which took place have been taken from the records of two ports, namely Kennebunkport, where nearly all of the output consisted of freighters, and Portsmouth, where a number of packet ships and clippers were also built. These figures indicate fairly well this feature of the development of American designs.

The Atlantic packets and the clipper ships naturally reached sizes considerably in excess of those of freighters. Notable advances were first made in the building of the former vessels. The regular New York transatlantic liners rose in size from about 400 tons in 1820 to about 600 tons in 1830, 800 tons in 1840, 1200 tons in 1850, and 1500 tons in 1855. The largest ship in operation in 1855 in the service to Liverpool measured 1749 tons,

in that to London 1771 tons, and in that to Havre 1349 tons.[3] Some of the notable big ships placed in this packet service were the Dramatic liners *Garrick*, *Siddons*, and *Sheridan* of 895 tons each, which were launched in the years 1836–1837; the *Roscius* of the same line, 1030 tons, launched 1838, the first liner to exceed 1000 tons; the Liverpool liner *Queen of the West*, 1160 tons,

SIZE OF FULL-RIGGED SHIPS BUILT AT KENNEBUNKPORT AND PORTSMOUTH[4]

	Kennebunkport		*Portsmouth*	
Years	*No.*	*Average size*	*No.*	*Average size*
1825–29	3	300	19	361
1830–34	5	324	16	458
1835–39	7	372	24	572
1840–44	4	452	12	655
1845–49	22	575	23	833
1850–54	28	890	43	1063
1855–59	21	905	31	1087

1843; the Red Star liner *Constellation*, 1560 tons, 1849; the Black Ball liners *Isaac Webb*, 1359 tons and *Great Western*, 1443 tons, 1850 and 1851 respectively; and the Dramatic liners *Webster*, 1727 tons, and *Calhoun*, 1749 tons, both 1853. Topping the list were the three big ships built by Donald McKay in the 'fifties for the White Diamond Line operating from Boston to Liverpool: the *Staffordshire*, of 1817 tons, and the *Chariot of Fame* and *Star of Empire*, 2050 tons each. It should be recognized that many of the immigrant-carrying cotton ships rivaled in size and appointments the regular liners. A particularly notable ship was the *Ocean Monarch*, a 2145-ton vessel built by W. H. Webb in 1856. An idea of the size of these big packets and combination ships may be had by examining the dimensions of several. Those of the *Queen of the West* were: length, 179 feet, beam, 37½ feet, depth, 22 feet; those of the big *Calhoun* were, respectively: 206, 43, and 29 feet. Vessels of 900 tons or more normally carried three decks at this time; on the lowest deck from 300 to 800 immigrants were carried in open bunks. On the upper 'tween decks there were usually quarters for the crew forward, second-

[3] Albion, *Square-Riggers on Schedule*, p. 274.

[4] Compiled from J. Edmonds, *Portsmouth City Directories*, 1839, 1851, 1857, 1860; and Bryant.

class passengers amidships, and cabin passengers aft in small, two-berth staterooms. The quarters of the cabin passengers were now relatively luxurious. On many ships there were well-appointed saloons, and the cabins usually had washstands and other conveniences. These larger ships were more powerful, seaworthy, and comfortable than the early packets and regular traders. They thus brought a new standard into the important Atlantic passenger service.

A few of the California clipper ships of the 'fifties exceeded in size the large Atlantic packet ships. The majority measured between 1100 and 1300 tons register. The average tonnage of the extreme clipper ships listed by A. H. Clark rose from 1100 tons in 1850 to 1240 tons in 1851, 1253 tons in 1852, and 1478 tons in 1854, in which latter year fifty such vessels were built, but it subsequently declined slightly.[5] A few of these vessels were of huge size for the times. Among them were the ship *Staghound*, 1535 tons, of 1850 — a McKay product which was said to be the largest merchant ship in the world when built; W. H. Webb's beautiful ship *Challenge*, 2006 tons, of 1851; and Donald McKay's seven great masterpieces, the ships *Sovereign of the Seas*, 2421 tons, *Empress of the Seas*, 2200 tons, *Lightning*, 2083 tons, *Champion of the Seas*, 2447 tons, *James Baines*, 2525 tons, and *Donald McKay*, 2594 tons, and the remarkable four-masted bark *Great Republic*, 4555 tons. All of these vessels were considerably smaller than their registered tonnage indicated because of their sharp ends, of which no account was taken in the formula. Hence they were somewhat smaller than the large wooden grain ships which were later built at Bath, Thomaston, and other eastern ports. They were, however, a great advance over previous practice both in the United States and in Europe.

The construction of vessels of such size was a notable achievement for the American builders, although British yards had been accustomed to constructing Indiamen of over 1000 gross tons in size for some years.[6] Serious problems were encountered. The size of these ships, their relatively great length, the heavy rigs aloft, and the hard sailing to which they were subjected imposed severe strains on the hulls, and consequently placed a premium

[5] Compiled from A. H. Clark, Appendix I.

[6] Memorandum of C. Grant, Director of the E. I. Co., [British] *Report on the Trade with the East Indies and China* (1821), pp. 162–163.

on large timbers, now growing scarce, and on mechanical skill on the part of the builders. On the other hand, the larger and relatively longer hulls were easier to drive, were more economical to navigate, except in the case of the extreme clippers, and were safer and more weatherly than the former short, deep, blunt-ended hulls. Structural problems now came to the fore. The great strains imposed were met by the builders by adding more and larger timbers, which were carefully fastened together so as to permit of as little working in a seaway as possible. The floor timbers of the larger ships, which were often of heavy live oak, were now usually laid solidly from bow to stern. The backbone was strengthened by heavy oak keelsons, 10 to 14 feet high, which were flanked by huge sister keelsons. Heavy inside skins, called ceilings, were laid, especially at the turn of the bilge, and on these at intervals heavy 10-inch-square strakes were placed to give increased strength. The clamps and waterways, which carried much of the strain near the deck, were also made very heavy. Sometimes two or three bulkheads (which, however, were not usually made watertight) were built in to stiffen the vessel.[7] The whole structure was still further strengthened by heavy, hard-pine planking outside and by large iron straps which were fastened inside in criss-cross fashion to the frames of the middle section.[8] Great care was taken by the leading builders to see that all timber was perfectly cut, fitted, and fastened, for otherwise looseness was certain to develop after a few years. It was in this work that the skill of the city builders gave them an advantage. Despite these precautions, the rapidity with which clipper-ship hulls loosened in the severe Cape Horn weather clearly showed that the technical and economic limits of wood as a material were being approached.

2

Notable improvements were also made in hull models, but it is extremely difficult to trace the course of innovation because of the lack of records and the tendency of the builders to copy one another. The ratios of the length to the beam and the depth were

[7] See, for instance, the description of the passenger ship *Empire State*, built by Fernald-Pettigrew in 1848, in the *Rockingham Messenger*, Portsmouth, N. H., March 8 and April 12, 1849.

[8] Hall Report, p. 67.

substantially increased on the whole, thus enabling better lines to be secured both forward and aft. Cargo ships were generally given flat floors and hard bilges, thus providing good carrying capacity and enabling the shallow draft to be secured which was necessary to cross the Mississippi bar. They also had fairly sharp, though convex, bow lines instead of the bulging, rounded sections which were formerly common. Considerable length was given to the full-bodied portion of the vessel amidships, and short, though fairly easy, runs were provided. Thus cargo ships were much more nearly streamlined than formerly, and their sailing ability was correspondingly improved. But acting under the influence of the admeasurement rule builders provided many freighting ships with kettle-bottomed midships sections, which were narrow at the deck but swelled out to great width at the waterline, in order to reduce port dues. Many master carpenters felt, in fact, that the admeasurement rule seriously encouraged the construction of deeper, fuller, and more clumsy vessels than economic conditions warranted. On the whole, however, the models of all types of vessels were greatly improved.

It was in the North Atlantic packet ships that many of these innovations were tried out. The early vessels had, to some degree, resembled frigates, being given a substantial amount of deadrise, well rounded bows, fairly long runs, and a midship section well forward. The newer vessels, however, because of the demand for passenger space and the importance of being able to negotiate the entrance to New Orleans, to which port many went on occasion, and of carrying large cargoes, were given greater length, nearly flat bottoms, and moderately sharp ends — a design which made them relatively easy to drive, more comfortable, and more economical. It is probable, however, that much of the increased speed which was achieved was due to their much larger size. It is claimed that this form of hull was first introduced on the North Atlantic in the Dramatic Line ships built in 1836 and 1837, and that it soon proved to be very successful. The *Siddons* is said to have sailed the Navy's fast frigate *United States* hull down in ten hours in 1839.[9] In the 'forties most of the new packets built were of this model. The averages of the crucial westbound voyages to New York, therefore, fell in the case of the Liverpool ships from 37.9 days in the years 1818–1832 to

[9] Cutler, pp. 95–97.

34.3 days in the years 1833–1847, and in the case of the Havre ships from 40.0 to 37.7 days.[10] This reduction was not large, but it did indicate an improvement in the designs.

The clipper ships were sharper, faster, and more weatherly, but less economical vessels than the packets. They represented a synthesis of several types. Sharp vessels of small size had been common in Europe for centuries, especially in the Mediterranean, and had been built in the United States for privateering, smuggling, and slaving during the early national period. These vessels, which were commonly known as Baltimore clippers, were unlike the later Californiamen in that they were small, possessed extreme deadrise, a midships section well forward, a large drag to the keel, and very small carrying capacity in comparison to their length and cost, and were generally rigged as brigs or schooners. The Baltimore builders were, however, experimenting with the design. They adapted it for full-rigged ships on several occasions, and these vessels may have influenced the builders of the California clippers.[11] For instance, in 1838 we find that the full-rigged slaving ship *Venus* of Baltimore, 450 tons, "built on the most approved lines for swift sailing," was unsuccessfully chased by the fast British sloop-of-war *Pelican* off Lagos.[12] In 1839 Kennard and Williamson of Baltimore built the fast experimental ship, *Ann McKim*, 494 tons, for the China tea trade, in which speed then brought premium freights.[13] By the early 'forties a number of builders had concluded that the sharp bows and concave lines of such vessels could be advantageously combined with the horizontal keel, flat floor, and hard bilges of the fast freighter or packet. Such a design was advocated by J. W. Griffiths in 1841,[14] and, perhaps in a modified form, was used in the China ships *Akbar*, built by Samuel Hall in 1839, *Probus*, built by J. Stetson in 1841, and *Helena*, built by William H. Webb in 1841, all of which were relatively fast.[15] However, the first extremely sharp ship of this type to be built is said to have been the *Rainbow*, 752 tons, which was designed by Griffiths and built by

[10] Albion, *Square-Riggers on Schedule*, p. 317.

[11] Chapelle, *The Baltimore Clipper*, pp. 78–79.

[12] *Report on Search or Seizure of American Vessels on the Coast of Africa* (1841), House Exec. Doc. no. 115, 26 Cong., 2 Sess., pp. 20–21, 106, 110.

[13] A. H. Clark, pp. 61–62.

[14] A. H. Clark, pp. 65–67.

[15] Cutler, pp. 99–100.

Smith & Dimon at New York in 1845. This vessel was employed in the China trade, in which she proved to be fast and successful. The *Rainbow* became, therefore, a prototype of other fast though small ships, and eventually of the large California clippers.

During the 'fifties the great urge for speed caused builders to ignore completely consideration of the admeasurement rule, carrying capacity, economy of navigation, and expense of construction. Consequently this type of extreme design was rapidly carried to its ultimate perfection. The high speed was secured by still further increasing the ratio of length to beam, by enlarging the hull to give more power in head wind and sea, by sharpening the ends and making them long, concave, and knifelike, by shortening the main body of vessel, which was then placed amidships and had a relatively flat floor, and by providing sufficient depth of hull so that, when loaded, the vessel could carry a large sail plan to windward against a strong gale. The old round bow lines above the water, which had formerly been preferred by navy men because of the advantages which they offered for the use of bow guns and by owners and captains because of their buoyancy and carrying capacity, gave way to a sharp, knife-like entrance. Aft the old broad square transom was either narrowed appreciably or was discarded in favor of a round one. The American California clippers were thus a synthesis of the best features of other designs.

These vessels soon disproved the fears of some that they would not stand up under their canvas and would not be sufficiently seaworthy. They proved, in fact, to be extremely fast, especially in heavy weather when speeds of from 14 to 18 knots were often achieved, and to be powerful weatherly vessels when beating to windward in the North Atlantic or off Cape Horn. Their passages were, in general, from 30 to 50 per cent shorter than those of full-built freighters, depending on the weather conditions and the route considered. They did not, however, dispel the misgivings of those who feared that their low carrying capacity made them dangerous investments.

The rigs given to the clippers, packets and large freighters were, in general, larger and heavier than had been placed hitherto in any but large warships. Practically all large vessels now carried a fourth square-sail, or royal on each mast, and many were given a fifth sail, or skysail, thus carrying the rigs almost two

hundred feet above the deck. The size of the individual sails was also greatly increased. In the 'fifties the lower masts of big ships ranged between 80 and 130 feet in length, top-masts between 60 and 75 feet, and the main yards between 75 and 90 feet. An enormous amount of standing and running rigging was consequently required to stay and operate these rigs. The labor cost per cargo ton carried was, therefore, relatively high on many of the crack clippers. For instance, the celebrated *Sovereign of the Seas*, when fully-manned, carried the huge complement of eighty seamen, ten boys, six petty officers, and five cooks and stewards. The *Challenge* required fifty-six men and eight boys. Indeed, the economic limit in the size of rigs, sails, and gear was being approached on the larger clippers during this period.

3

During these years the builders of wooden ships in many other countries continued to have serious difficulties in obtaining suitable supplies of ship timber at cost levels at which shipbuilding could be actively prosecuted. Hence the shipbuilders of the United States, and the owners as well, continued to enjoy a marked advantage. Timber of local growth became even more difficult to secure in Great Britain, France, Spain, and the low countries. The situation was aggravated because the larger vessels which owners now demanded required heavier pieces. In Great Britain the builders, who still preferred to fashion their large keels, stems, and sternposts out of the famed English oak, found it practically impossible to secure such pieces.[16] In fact, by 1850, British-grown lumber was difficult to secure at satisfactory prices along the entire seaboard of the British Isles. At Sunderland, for instance, where many wooden vessels were constructed, it was necessary, as a rule, to use either inferior local woods or imported materials. Builders complained vigorously about the high cost and poor quality of much of this material and of the costs and delays encountered in securing pieces from abroad.[17] Indeed the passage of time had made the situation in the shipbuilding industry abroad worse rather than better.

[16] T. J. Ditchburn, discussion, *Trans. I.N.A.*, IV (1863), 148.

[17] *Report of the* [British] *Select Committee on Merchant Shipping* (1844), pp. 30–31, 63, 83–84; *Report of the* [British] *Select Committee on Merchant Shipping* (1860), pp. 18, 148, 361–362.

The differential in timber costs between American and European yards, nevertheless, narrowed appreciably during the boom of the 'fifties, and by the 'sixties had nearly disappeared. In Europe, the supply, which had been inelastic as long as local sources were used, became, at the import level, extremely elastic as shiploads from the then apparently inexhaustible hardwood forests of Germany, Poland, Russia, and the upper St. Lawrence, the soft-wood forests of Scandinavia, Russia, and Canada, and the woods of the tropical forests of India and Africa poured in. In the United States, on the other hand, the supply became more inelastic as the principal sources of the supplies moved, first into the deep hinterland behind the seaports, and, second, to the Great Lakes and Ohio River areas. Furthermore, in Canada at Quebec, St. John, and many other shipbuilding towns, timber, which was more plentiful, became cheaper than in the United States. British timber prices had generally been reckoned to be about double those in the United States in the 'thirties,[18] but by the late 'fifties this differential had been pared to a substantial extent.

Furthermore, skilled labor was more plentiful and was considerably cheaper both in Europe and in Canada than in the United States, and as the timber advantage dwindled this differential became of dominating importance. Skilled shipyard workers were being paid in 1860 from 4*s.* to 7*s.* 6*d.* per day at London,[19] from 3*s.* to 6*s.* 6*d.* on the Clyde,[20] from 3*s.* to 5*s.* at Sunderland,[21] and 7*s.*, a union rate, at Liverpool.[22] These rates were, roughly, about 50 per cent less than those in the United States. Canadian yards possessed a similar advantage in 1860, the rates of pay being from 8*s.* to 9*s.* per day at St. John, N.B.,[23] and 7*s.* 6*d.* at Prince Edward Island [24] — that is, from $1.60 to $1.80 per day. The advantage of these foreign centers may have been somewhat less than the figures indicate, however, for both

[18] *Report of the* [British] *Select Committee on Manufactures, Commerce, and Shipping* (1833), p. 422.

[19] Dispatch of F. H. Morse, U. S. Consul General at London, Lynch Report, p. 220.

[20] Lynch Report, p. 220.

[21] Statement of Peacock Bros. of Sunderland, Lynch Report, p. 223.

[22] Lynch Report, p. 225.

[23] Lynch Report, p. 228.

[24] Lynch Report, p. 230.

the American master builders and the American consul at London were of the opinion that the shipyard workers in the United States worked more rapidly and efficiently than those in many places abroad.[25]

In addition, the iron fastenings, straps, chains, anchors, and other fittings commanded higher prices in the United States than in England, in Canada, and on the Continent, because of transportation charges and import duties. The shipbuilders, who used English iron extensively, complained bitterly of the duties. The rates on hammered bar iron were moderate under the Tariff Acts of 1846 and 1857, being 30 and 24 per cent ad valorem, respectively;[26] but in 1861 and again in 1864 they were greatly increased. It was estimated by the shipbuilders that the duties on the ironware used in a typical sailing ship, which had been about 24 per cent ad valorem in 1857, rose to 50 per cent in 1861, and 112 per cent in 1864.[27] The total duties on the materials used in a 1000-ton full-rigged ship ranged between $1000 and $1200, or approximately from 1.5 to 2.0 per cent of the cost of these vessels in the 'fifties. During the latter 'sixties, however, they ranged between $7000 and $8000, or approximately from 10 to 12 per cent of the cost.[28] The estimated tariff burden for such a vessel under the Act of 1864 was given by Donald McKay as follows: iron, $1209; spikes, $249; galvanized spikes, $60; castings, $216; chain cable, $1458; anchors, $241; metal and nails, $712; salt, $216; manila, $311; hemp, $863; duck, $715; Canadian knees and timber, $1155; copper and miscellaneous material, $1261 — a total of $8665.[29] This was a serious matter. During the clipper-ship era, however, the burden, although noticeable, was not disastrous.

Offsetting these disadvantages were the notable improvements which were made in the tools and in the efficiency of many American shipyards, which made them the most advanced establishments in the world for the construction of wooden ships. The more important firms increased roughly three- or four-fold in size and capital investment. The yearly business done by a typical large yard increased from, say, two vessels of 300 tons,

[25] Statement of Samuel Hall, Lynch Report, p. 83; see also p. 220.
[26] Taussig, *Tariff History*, pp. 124–125.
[27] Lynch Report, p. 79.
[28] Lynch Report, pp. 19, 195, 212.
[29] Lynch Report, p. 203.

totaling about $21,000 in 1815, to, say, four vessels of 1000 tons, totaling about $240,000, in 1850. The business of some of the noted yards even approached $1,000,000 yearly. The number of workmen normally employed in building a full-rigged ship increased from between ten and twenty to between thirty and sixty in the same period. Although the form of organization was still that of the craft shop, a much more efficient division of labor was developed. The master carpenter often confined himself to designing and to the supervision of the methods of construction, and less frequently worked in the yard as a craftsman. Most important was the appearance of steam-driven sawing machinery. Specially designed tilting saws enabled frames to be cut and beveled and planking to be readily shaped, thus displacing hours of arduous and expensive labor by sawyers and adzemen.[30] The elaborate plant of Donald McKay, which was first set up at Boston about 1845 and was greatly enlarged in 1854, was particularly notable. Lathes for the manufacture of treenails were also devised about 1838.[31] This mechanization increased the efficiency of shipbuilding operations and partly offset the increase in labor costs.

The net result was that the prices of foreign-built wooden vessels rose but slightly between 1830 and 1860, whereas those of American-built ones rose substantially, thus narrowing the all-important differential. In the early 'thirties the prices of the best grades of oak and teak ships built in England were approximately between £15 and £25, or between $73 and $120 per gross ton, whereas those of American vessels rarely exceeded $50 per ton.[32] In 1844 it was estimated that first-class British sailing ships from the best yards of London, Plymouth, and Sunderland, and constructed of English oak and teak, cost owners between £18 and £25, or from $87 to $120 per gross ton, the majority being near the lower figure. First-rate American ships built of live and white oak then cost their owners from £2 to £3, or from $10 to $14 per gross ton less.[33] The stout but cheaply built New

[30] G. F. Dow and J. Robinson, *The Sailing Ships of New England*, ser. II (1924), p. 34.

[31] J. H. Morrison, *New York Shipyards*, p. 94.

[32] *Report of the* [British] *Select Committee on Manufactures, Commerce, and Shipping* (1833), pp. 226–227, 339–341, 347, 420–423.

[33] *Report of the* [British] *Select Committee on Merchant Shipping* (1844), pp. 57–58, 61–63, 83–84, 174–175.

England cotton ships were priced at as much as £6, or about $30, per gross ton less. Poorer grades of ships then could be had at Bristol, the Clyde ports, or Sunderland at from £10 to £12 per ton, but these vessels had difficulty in securing damageable cargoes in competition with American ships, except when new. By 1860 British prices had, however, changed little, if any. First-rate wooden ships, coppered, fitted with double outfits, and classed at fourteen years, were then quoted at from £16.16*s* to £21 per gross ton. Low-grade ships were priced at considerably lower figures, eight-year vessels being quoted, for instance, at £10 to £10.10s per ton.[34] These British prices were somewhat depressed, however, by the rising output in Great Britain of iron sailing ships, which were then becoming common and were priced at from £17 to £18 per gross ton.[35] Thus by the end of the 'fifties the price differential had considerably narrowed, for first-class American packets cost $70 per ton or more,[36] and clipper ships ranged from $55 to as much as $100 per ton, as we have seen. It does not appear that the prices of similar vessels in France, Holland, Hamburg, and Bremen were substantially less than in England. American yards thus still maintained some advantage, if ships of equal qualities are compared, and this was passed on to American owners until about 1854.

Prices of sailing ships were, however, considerably lower in Canada than in the United States during the great boom, and in consequence the shipbuilding industry there expanded with great rapidity. This expansion was promoted by the slow rate of agricultural and industrial development in the eastern provinces, which left the yards — which were chiefly centered around the Bay of Fundy at St. Andrews, St. John, St. Martins, Moncton, Dorchester, Maitland, Windsor, and Yarmouth, and on the upper St. Lawrence River — with relatively large stores of timber in their hinterlands. The free importation of iron and other materials also helped. These vessels, which in model resembled the American cargo ships,[37] were generally constructed at first of the relatively poor hardwoods, and later of Canadian spruce, which timbers were often used unseasoned, were frequently of light

[34] Lynch Report, pp. 217, 224.
[35] Lynch Report, p. 217.
[36] Lindsay, *History of Merchant Shipping* (1883), III, 141n.
[37] *Report of the* [British] *Select Committee on Merchant Shipping* (1844), p. 61.

scantling, and were commonly poorly fitted and fastened. Hence, Canadian-built ships were thoroughly despised by the British and American builders, both of which were undersold.[38] Nevertheless, they began to play a large role in the world carrying trade.

Few of these vessels were operated under Canadian register. The majority were built on speculation for the Liverpool, London, and Plymouth ship markets, where they were sold at prices which sagged slowly from £7 per gross ton in 1837 to as low as from £2 to £3 per ton in the mid-'forties in consequence of an oversupply. At such figures they not only broke the market of the British builders, who asked for a tariff on them, but also provided British owners with the only supply of vessels which they could effectively employ in the North Atlantic carrying trades in competition with American ships.[39] Hence, from an average of 50,920 gross tons yearly during the period 1828–1838, sales in the British market rose rapidly as British shipbuilding died. The prices of these vessels failed to rise substantially during the boom, the figures for 1860 for the best grade being £7 ($34) per ton at Liverpool, $36–$38 at Quebec, and $37–$40 at St. John, at which prices they were about a third cheaper than American-built freighters.[40] At this time even American firms began to consider making investments in "Bluenose" ships.

The Canadian-built spruce ships, because of the lightness of the wood, could lift about 25 per cent more weight than oak ships and 16 per cent more than oak, hard pine, and hackmatack vessels of the same registered tonnage. Hence they had an advantage over United States ships in this respect. Great care was necessary, however, in seasoning the timber; it was essential that it be cut in the winter season, heavily salted, and well ventilated, and that the vessel be kept out of warm water during the first year.[41] When these things were done, Canadian vessels often remained in good condition for sixteen to twenty years, or nearly as long as American oaken ones. Canadian builders did not, however, restrict their operations entirely to low-grade ships. They began to build vessels of better model, timber, and construction in the

[38] *Report of the* [British] *Select Committee on Merchant Shipping* (1844), pp. 62–65, 215–216; Lynch Report, pp. 228–229.

[39] *Report of the* [British] *Select Committee on Merchant Shipping* (1844), pp. 57, 63, 180.

[40] Lynch Report, pp. 217, 225–229.

[41] Lynch Report, pp. 228–230.

late 'forties and 'fifties. Hence they were strong competitors of the Americans in the British and French ship markets when these markets were opened to international competition. A particularly noted vessel which greatly enhanced the prestige of Canadian builders was the celebrated fast Australian Black Ball liner *Marco Polo*, which was built at St. John in 1851.[42] Thus Canada appeared on the horizon as a serious rival during the years of the great boom.

4

It was generally recognized by shippers and freight agents during the late 'forties and 'fifties that American shipbuilders had achieved a position of international leadership in the design of sailing vessels, although in the construction of iron hulls and steamships they were very backward. This leadership clearly offset in part the diminution of the favorable differential in ship prices. In size, carrying capacity, speed, cargo turnout, and weatherliness, the new large American freighters were superior to practically all foreign vessels. Hence they generally secured significant freight premiums and lower insurance rates. Only the low-priced wooden ships of Canadian build, which were the only wooden vessels which many foreign owners could profitably use in the competitive carrying trades, and which gradually improved in quality, were serious rivals for the business. In the high-grade North Atlantic trade the splendid American liners also secured the best cargoes and most of the passenger business until iron steamships entered the trade in large numbers.[43] In the long-voyage trades the clippers, the fine lines of which enabled them easily to outsail the full-bodied, deep vessels commonly employed by foreign owners, likewise achieved a technical triumph.[44] Hence American ships were in great demand during this period because of their technical superiority.

As is often the case, however, the American leadership in design and construction was destined to be short-lived, for the stimulus of competition, the reform of the British admeasurement

[42] Wallace, *Wooden Ships and Iron Men*, pp. 44–53; Basil Lubbock, *The Colonial Clippers* (1921), pp. 26–41.

[43] *Report of the* [British] *Select Committee on Merchant Shipping* (1844), pp. 61–68.

[44] Address of the Rt. Hon. Sir John Pakington, President of the Institution of Naval Architects, *Trans.*, *I.N.A.* (1860), I, 3–4.

rule in 1854 [45] as a result of which the deep, full-ended hull was no longer encouraged, and the early introduction of iron as a basic material soon led to the production of many large fast well-built vessels abroad, notably at Aberdeen and Liverpool. Although a few fine-lined vessels had previously been built in England,[46] the first clipper was probably the ship *Stornoway*, 506 tons, which was launched at Aberdeen for the China trade in 1850.[47] Others followed, and by 1856 these vessels had partially restored the prestige of British builders. Fine-lined vessels were also laid down in France at Bordeaux and Havre in the 'fifties.[48] By 1860 the leading foreign firms were building vessels which were as good or better than any constructed in the United States.

The United States became during the boom the leading shipbuilding nation of the world, being followed by Great Britain and Canada. During the years prior to the great boom, 1831–1846 inclusive, there were built and documented in the United States 1,595,000 gross tons of sailing ships, compared with 1,890,000 gross tons in the United Kingdom, and 1,344,500 gross tons in the British possessions.[49] Of the last named Canada was foremost, constructing approximately three-fourths of the tonnage. During the eleven years of the boom, 1847–1857, however, the windjammers built in the United States totaled 3,390,500 gross tons compared with about 1,757,000 gross tons in Great Britain, and about 1,672,000 gross tons in the British possessions.[50] Thus the output of sailing vessels in the United States was about double that in Great Britain and more than double that in Canada. Even with the addition of the 550,000 gross tons of steam vessels built in the United Kingdom to the latter's total, the American production exceeded the British output by over 1,000,000 gross

[45] G. Mooresom, "On the New Tonnage Law, As Established in the Merchant Shipping Act of 1854," *Trans., I.N.A.*, I (1860), pp. 128–130. Under the new rule the internal capacity was accurately determined in tons of 100 cubic feet regardless of form.

[46] *Report of the* [British] *Committee on Merchant Shipping* (1844), p. 72.

[47] A. H. Clark, pp. 198–199; Lindsay, *History of Merchant Shipping*, III, 294.

[48] P. Charliat, *Trois Siècles d'Economie Maritime Française* (1931), p. 135.

[49] A.R.C.N., 1901, pp. 474–475, 581–582.

[50] A.R.C.N., 1901, pp. 474–475, 581–582. The returns have been corrected for the estimated difference between the net tonnage, in which the British returns are given from 1854 on, and the gross tons in which the American figures are expressed. For sailing ships it was estimated that the net tonnage was from 5 to 9 per cent less than the gross tonnage. See A.R.C.N., 1901, p. 469.

tons.[51] Thus, despite the rising costs of construction in the United States, the protection accorded to the Californiamen and the technical superiority of the American clippers and packets produced a shipbuilding boom which carried American output far into the lead.

The industry of building wooden ships in Britain was, on the whole, seriously depressed until the early 'fifties, although many of the trades in which British ships were employed were protected by the navigation acts, traffic was expanding, and British merchants dominated world commerce. British shipowners gave few orders prior to 1850, however, for liners and freighters for services in which American competition was to be met. The financial position of the British builders was also undermined by the sale first of cheap "colonial-builts," and later of the more expensive, but higher-quality, "American-builts." During the 'fifties, however, the strong demand for tonnage produced temporary prosperity. The industry was also adversely influenced to an increasing extent by the industry of building iron ships, which accounted for 26 per cent of the total net tonnage built in 1853 in Britain for British owners, and 30 per cent in 1860.[52] The shipbuilding industry was also depressed on the Continent, except in the Baltic. French, Dutch, Spanish, West German, and Italian firms likewise found great difficulty in building vessels which could compete with the new United States merchantmen. Few vessels appeared under these flags in the trades frequented by American ships. This was truly the golden age of the American shipbuilders, but their unparalleled prosperity was soon to turn into sudden disaster.

5

The basic international position of the American shipping industry deteriorated notably in the 'fifties, despite the high rate of construction and rapid expansion of the fleet. This was the result of the rising costs of construction in American yards, the

[51] A.R.C.N., 1901, pp. 474–475. The net tonnage of steamships built was 421,252, to which an estimated 129,000 tons was added in order to secure the approximate gross tonnage.

[52] Joseph Nimmo, *Report to the Secretary of the Treasury in Relation to the Foreign Commerce of the United States and the Decadence of American Shipping* (1870), House Exec. Doc. no. 111, 41 Cong., 2 Sess., p. 46. (Hereafter cited as the Nimmo Report.)

growing costs of manning the ships, the development of large-scale sales of Canadian- and American-built wooden tonnage to European owners, and the improvements in design and construction achieved by the builders abroad in the latter part of the boom. Between 1857 and 1865 these factors, together with the depression of 1857 and the Civil War, were to produce a spectacular collapse. This deterioration is shown by the fact that the American proportion of the tonnage entering and clearing in foreign trade fell steadily from the relatively high levels of the early years of the Republic, which were, with a few exceptions, over 85 per cent, to between 60 and 70 per cent during the 'forties and 'fifties. The average proportions were 71 per cent in the 'thirties, 67 per cent in the 'forties, and 64 per cent in the 'fifties.[53] The effect of the strong demand for American tonnage during the early years of the California gold rush, and of the consequent withdrawal of vessels from other services was particularly pronounced, the proportion falling to 60 per cent in 1850, after which it slowly rose, reaching 71 per cent, the last high mark of the century, in 1860 as the clippers abandoned the California trade. These figures indicate increasing pressure by foreign firms in the foreign carrying trades.

The American merchant fleet nevertheless expanded rapidly in size. The registered tonnage employed in the foreign and California trades rose from 537,563 gross tons in 1830 to 762,838 gross tons in 1840, to 1,439,694 gross tons in 1850, to 2,348,358 gross tons in 1855, and to a peak of 2,496,894 gross tons in 1862, a figure which was not to be passed until 1918.[54] This fleet consisted almost entirely of sailing ships, the registered steam tonnage being but 4,155 gross tons or 0.5 per cent of the total in 1840, 44,942 gross tons or 3.1 per cent in 1850, 115,045 gross tons or 4.9 per cent in 1855, and 113,998 gross tons or 4.6 per cent in 1862.[55] The fleet employed in the coastwise trade continued its steady growth, rising from 516,979 gross tons in 1830 to 2,616,716 gross tons in 1862. A considerable proportion of this latter fleet consisted of steamboats, which were mainly employed on the eastern and western rivers. In 1862 there were under enrollment for all purposes 2,175,540 gross tons of sailing

[53] A.R.C.N., 1901, p. 494.
[54] A.R.C.N., 1901, pp. 560–563.
[55] A.R.C.N., 1901, pp. 530–531.

vessels and barges and 596,465 gross tons of steam vessels. The total mercantile marine employed in deep sea, coastwise, and inland traffic and in the fisheries rose from 1,191,776 gross tons in 1830 to 5,112,164 gross tons in 1862, an increase of 429 per cent. Shipowners thus had little of which to complain, although certain disquieting conditions developed.

In the foreign trade, American ships were generally manned at a cost equal to or lower than were those under the British and most other foreign flags, but this competitive advantage was obtained at this time mainly through hard man-driving and superior seamanship on the part of the officers, and resulted in the almost total disappearance of native-born seamen, their places being taken by Irish, English, Germans, and Scandinavians, for the most part. During the 'forties British vessels were required to carry four men and one boy per 100 tons on sailing vessels, or a crew of forty men and ten boys on a 1000-ton vessel, whereas American freighters carried from two to three men per 100 tons, or from twenty to thirty men on the same size of ship. Although the British law was often evaded, the American advantage was still considerable, probably being about 1.5 men per 100 tons in most cases.[56] On the other hand, wage rates were from 25 to 50 per cent lower in foreign vessels, and the scale of victualing was often inferior to that on American craft. This situation produced the result that, although Americans were ceasing to take employment in large numbers, many Europeans sought employment in the American service.[57] In this way it was possible to continue to operate these great sailing ships despite the fact that in general the earnings of skilled labor were relatively high in the United States.

The foreign sailor, who received about $25 per month, could scarcely hope to become an officer, however; and hence a wide gap arose between the men on the quarterdeck and those in the forecastle. Seamen on American vessels became at this time a special foreign group whose wages were determined by the necessity of enticing foreign sailors into the American service and the need of preventing desertion to the relatively unskilled alternative

[56] *Report of the* [British] *Select Committee on Merchant Shipping* (1844), pp. 33, 52, 57, 75.

[57] *Report of the* [British] *Select Committee on Merchant Shipping* (1844), pp. 100–101.

employments available to sailors ashore. These wages were not as high as native Americans received in comparable work on shore, and would not have produced an adequate supply of native-born seamen. Foreign crews, which were often ignorant and irresponsible, frequently worked long hours under a harsh discipline and sailed on undermanned vessels on which the risk of disaster or physical injury was considerable. As time went on and international competition became more severe, the exploitation of seamen by boarding-house masters and shipowners was to increase, and this was to be accompanied by a deterioration in the skill, physique, and morale of the crews, and inevitably by a decline in the efficiency of American shipping.[58] The first stage in this process was reached during this period.

6

A change of primary importance, because of its impact on American shipping, was the repeal of the British navigation laws in 1849.[59] This action was a major step leading to the establishment of free navigation throughout a large part of the world, and to the free purchase of vessels by the leading nations of Europe. There can be no doubt that this action, which was undertaken in part under the influence of free-trade philosophy, was well calculated to remove the chief obstacles to the expansion of British shipping. Although it was basically in a strong competitive position because of an abundant supply of capital and labor and of the dominant position of British commercial enterprise in world commerce, this industry had been placed, as we have seen, at a serious competitive disadvantage as a result of the protection which had been accorded to the British shipbuilders under the registry laws since the American Revolution. Some relief had been achieved through the purchase of colonial-built vessels. Although this disadvantage had tended to narrow as the century progressed, the improvements in design and construction in the United States provided an offsetting force. The position of British shipping was thus dependent to a high degree on the maintenance of protection on as many sea routes as was possible without causing disastrous retaliation. This protection was accorded by the navigation laws, which, although extremely complicated, in gen-

[58] Statement of Captain W. Ryan, Lynch Report, pp. 126–130.
[59] 12 & 13 Vic. c. 29 (June 26, 1849).

eral provided for a series of bilateral navigation monopolies in which navigation was open only to the vessels of Britain and the nation at the other terminal of each sea route. The expansion of British shipping during the first half of the nineteenth century may therefore be ascribed, on one hand, to the growth of trade on these protected routes, on many of which first-class vessels were used, and, on the other, to the employment of cheap colonial-builts in the rising competitive North Atlantic trades.

These laws, as they existed in 1847 after having been subject to much patchwork, preserved as much as possible of the long-voyage trade to British vessels. They have been summarized as follows:

1. Certain enumerated articles of European production could only be imported into the United Kingdom, for consumption, in British ships, or in ships of the country of which they were the produce, or in ships of the country from which they were usually imported.

2. No produce of Asia, Africa, or America could be imported for consumption into the United Kingdom from Europe in any ships; and such produce could only be imported from any other place in British ships, or in ships of the country of which the goods were the produce, and from which they were usually imported.

3. No goods could be carried coastwise from one port of the United Kingdom to another in any but British ships.

4. No goods could be exported from the United Kingdom to any of the British possessions in Asia, Africa, or America (with some exceptions in regard to India) in any but British ships.

5. No goods could be carried from any one British possession in Asia, Africa, or America to any other, nor from one part of such possession to any other part of the same, in any but British ships.

6. No goods could be imported into any British possession in Asia, Africa, or America, in any but British ships, or in ships of the country of which the goods were the produce, provided, also, in such case, that such ships brought the goods from that country.

7. No foreign ships were allowed to trade with any of the British possessions unless they had been specifically authorized to do so by Order in Council.

8. Powers were given to the Queen in Council which enabled her to impose differential duties on the ships of any foreign country which did the same with reference to British ships.

9. Foreign ships might export any goods to any foreign country.[60]

The resulting transportation system was undoubtedly inefficient, costly, irrational, and injurious to the economic interests of the country and of the many other nations which were also

[60] Lindsay, *History of Merchant Shipping*, III, 107–109.

affected by these regulations. Consequently, with the development of a more intricate pattern of world trade and the rise of free-trade philosophy, it was inevitable that the system should be attacked. On the question of the injury done to the British economy as a whole there proved to be little doubt. That the British mercantile marine was relatively costly to build and was relatively inefficient in operation, and that the regulations seriously hampered the adjustment of voyage patterns and the supply of vessels to the demands for tonnage and often caused an undesirable routing of cargoes were amply proved. Colonial interests objected to the high freight rates which they encountered; the free-traders objected to the resulting addition to the cost of food, raw materials, and other essential imports; the manufacturers to the added cost of delivering exports; and the merchants to the obstacles, absurdities, and injustices in administration which they encountered. Others could see little justification for protecting shipowners and builders now that protection to agriculture had been discarded with the repeal of the Corn Laws under Peel in 1846 following a long battle by Richard Cobden and the Anti-Corn Law League, and protection to industry had been largely abolished by Huskisson and Peel. Fears for the trade balance, formerly a primary element in mercantilist thought, had largely disappeared under the practical arguments of the Manchester manufacturers and the theoretical exposition of the Ricardian school of economists.

On the issues of national defense, fair competition, reciprocity, and the effect of repeal on British and foreign shipping there was more disagreement. The shipbuilders, who scarcely foresaw the rise of shipbuilding in iron, correctly argued that the opening either of the protected trades to foreign vessels or of the domestic ship market to foreign shipbuilders must inevitably destroy their remaining markets — an eventuality which no improvement in design or reduction of duties on materials was likely to prevent. They had been hard pressed by Canadian competition in 1844 and had even asked that a duty be placed on these vessels. Many shipowners, while admitting that British vessels sailed as cheaply as foreign ones and that there was opportunity for an increase in efficiency, nevertheless feared that if the monopolies were abolished the protection accorded to the builders would not be abandoned, and that they consequently would be left to face

unsuccessfully the competition of lower-priced and better-modeled foreign vessels. Finally, the Royal Navy, which for tactical reasons desired strong shipbuilding and shipping industries, raised the serious theoretical question as to whether or not the general economic interests should be sacrificed for immediate naval security.

The British government believed, however, that the economic interests of the country required the sacrifice of the shipbuilding industry in order to secure a more efficient transportation system. The repeal bill, embodying the principles of free navigation and free purchase, hence finally passed, and received the royal assent on June 26, 1849, after two years of discussion. The American government, acting under the Act of 1828, consequently opened American ports to any British vessel coming from any foreign port and laden with any cargo, effective January 1, 1850.[61]

Numerous other commercial nations had also agreed, or soon were to agree, to enter into initial or further relations of maritime reciprocity with the United States. Treaties providing for more or less free navigation were concluded as follows: Prussia, 1828; Mexico, 1831; Russia, 1832; Chile, 1832; Venezuela, 1836; Ecuador, 1839; Peru, 1851; Holland, 1852; Argentina, 1853; Belgium, 1858; and Paraguay, 1859.[62] Thus, with a few exceptions, free international competition in shipping was established over a large area by 1860. The American policy of reciprocity had thus almost achieved its goal. The free purchase of American ships was again possible for British owners. The unified economy of colonial days was restored, and furthermore, was greatly extended.

Although a mantle of pessimism subsequently settled over the British maritime industries, circumstances combined to make the readjustment less difficult than had been expected. The British shipbuilders were aided for a time by the classification rules of Lloyd's Register, the class of which was essential to shipowners, which body refused to accept some of the timbers and fastenings commonly used by American shipbuilders.[63] They were also assisted by the sharp rise in vessel prices in the United States

[61] Nimmo, *Report on Foreign Commerce and the Practical Workings of Maritime Reciprocity* (1871), House Exec. Doc. no. 76, 41 Cong., 3 Sess., pp. 8–9, 46.

[62] *Report on Foreign Commerce and the Practical Workings of Maritime Reciprocity* (1871), pp. 7–8.

[63] W. W. Bates, *American Marine*, pp. 140–145.

because of the California gold rush, by the development of improved models by British designers, and by the reform of the British admeasurement rule in 1854. The tonnage built actually rose because of the intense activity in trade from 649,547 net tons during the five years 1845–1849 to 869,458 net tons during the ensuing five years.[64] Thus the shipbuilders were saved from disaster by a combination of circumstances. The British shipowners were also aided by the intense demand for cargo space which existed between 1851 and 1856, by measures taken to increase the efficiency of British shipping, and by the purchase of many new vessels abroad. Boom conditions prevailed practically throughout the period of adjustment, and by 1857, when freight rates fell and international competition first became severe, the advancement made in iron production and in the construction of iron ships, coupled with the difficulties of the American builders, had removed the danger of a deterioration in the position of the British shipbuilding industry. Thus the results which were implicit in the measure when it was passed were never fully achieved, and Great Britain passed through the change without the loss of her shipbuilding industry.

7

In more normal times sales of American ships to British owners on a much larger scale would probably have occurred, but the actual sales, because of rising ship prices in the United States, were only moderate in amount. The total American tonnage both new and old, sold abroad, rose from a mere 12,621 gross tons in 1849 to 60,033 gross tons in 1854, the first year of substantial sales, and to a peak of 65,887 gross tons in the following year, but by 1860 had declined to 17,418 gross tons.[65] The number of full-rigged ships and barks sold, which is probably the best indicator, rose from three in 1842 to twelve in 1849, twenty-seven in 1852, fifty-eight in 1854, and seventy in 1855.[66] During the years 1854–1857, the four active years, 284 of these vessels, or 20 per cent of the 1272 built, were sold. Not all of this tonnage was sold in the British market, however, for the market of France was opened, subject to a 10 per cent ad valorem duty, by the

[64] A.R.C.N., 1901, p. 474.
[65] A.R.C.N., 1901, p. 586.
[66] R.C.N.T., for the years mentioned.

Decrees of 1854 and 1856.[67] Looking at these sales from the British viewpoint we find that the tonnage of the vessels purchased abroad by owners in the United Kingdom, chiefly sailing ships, was about 106,000 gross tons or approximately 48 per cent of the domestic output in 1854, a year of great scarcity of tonnage because of the requirements in the Crimean War, and was about 42,000 gross tons in 1855. Subsequently these purchases declined severely.[68] It is evident that the sharp business depression which set in in 1857, the cessation in the demand for fast vessels, and the improvements in European shipbuilding soon brought an end to the demand for American tonnage. Shipowners in the United Kingdom desiring wooden vessels generally transferred their purchases to Canada at this time, and others bought domestic-built iron ships. Thus by 1860 the influence of the repeal on American shipbuilding was rapidly declining. The Civil War produced, however, a temporary revival of foreign sales, but these were made at low prices.

American shipbuilders, notably those in Maine where much of the business was centered, thus frequently built vessels for the British market on speculation between 1849 and 1857. These ships were usually loaded with cotton at New York or a southern port and sent to England, where they were sold by agents as opportunities appeared.[69] A few ships were also built to order. Canadian- and Baltic-built vessels were likewise placed on the British market in competition with American craft. Some of the ships purchased from American builders during this period were ranked among the best vessels in the British mercantile marine. Especially notable were the famous clipper ships *Lightning*, *James Baines*, *Donald McKay*, *Champion of the Seas*, and *Red Jacket*. Thus American shipbuilders were able once again, and for the last time, to make a substantial contribution to British maritime development.

The establishment of policies of free navigation and free purchase in Great Britain, which were later to be imitated by other European nations, raised serious questions regarding American navigation policy. That these measures removed important ob-

[67] Lefol, p. 13.
[68] A.R.C.N., 1901, p. 477. The net tonnage figures are 97,641 in 1854, and 39,437 in 1855.
[69] Statement of John Hayden, Bath shipbuilder, Lynch Report, p. 12.

stacles to the development of a more efficient transportation system was scarcely doubted. They were, however, an ironical climax to the American reciprocity policy, which, in so far as it was opportunistic and was designed to further the maritime interests, had been based on the false assumption that American shipping operated at a substantial natural comparative advantage. This advantage had been actually caused primarily by the registry laws of the European nations, which were now being abandoned. Substantial competition was therefore certain to develop, and accordingly the United States government was faced for perhaps the first time with the broad issues of protection and free trade. Earlier measures had been designed primarily to retaliate rather than permanently to protect the maritime industries, but now both the navigation monopolies and the registry law were becoming somewhat protective. Hence major decisions had to be made.

The situation in the 'fifties appears to have called for policies of free navigation and free purchase so far as sailing vessels were concerned. These policies should, however, have been coupled with limited measures of support. Had such a combination of policies been followed, there is reason to believe that the American investment in each of the maritime industries would have been neither too large nor too small in relation to the economic resources of the nation. Unfair competition by foreign vessels was rare as long as sailing ships were widely used. There was every reason to believe that the mobility of the factors of production and the competitive conditions required to fit the assumptions of the classical theory of international trade existed to a substantial degree. Such a combined policy would have provided the United States with the most direct and economical transportation system possible for general cargo. Despite the most intelligent aid, however, some contraction in the American shipping industry would probably have occurred, especially if the coastwise trade had been opened, because of the competition of British and French owners, using cheaper and better vessels than they had formerly possessed. This competition might even have become serious because of the lower labor expenses of foreign ships. The reëstablishment of a navigation system, which was the only way in which this decline could have been readily checked, would have meant a complete reversal of American

policy, endless diplomatic difficulty, and in all probability effective and disastrous retaliation. From the economic standpoint it would also have been a naïve move.

On the other hand, American owners were well entrenched in many lines of business; they possessed some economies of scale, much good will, and many valuable business contacts. Serious efforts to preserve at least a part of this valuable organization should have been made. Because of the growing timber shortage in the United States and the developments in naval architecture abroad it was particularly important that American firms be free to buy at world prices such wooden, composite, and iron ships as their judgment dictated. Had this been possible many of the packet operators might have continued in business as owners of iron steam liners and the owners of tramp freighters might have bought composite or iron sailers. Money was readily available to such firms in London, and the crews were already largely foreign born. In this way a considerable portion of the country's shipping enterprise could have been saved and its vessels would have been of more value for purposes of defense than the wooden ones actually obtained. The shipyards would have lost a part of their business, especially during the high prices of the boom, but their timber would have lasted longer, and in any case the old shipyards were doomed, as the sequel will show. Certain moderate promotional and sustaining subsidies to the owners of certain vessels and to the builders of iron ships were justifiable at this time. In any case the economic and military interests of the nation were unlikely to suffer greatly from a liberal navigation policy.

The policy of the government was, however, a curious mixture of protectionism and free trade. The repeal of the American registry law, which formerly had been of minor economic importance but now was coming to the fore as the major maritime problem, was scarcely considered, although despite the exploits of the clippers, good and much cheaper sailing ships were being built in Canada, and what was of even more importance, cheaper and better ocean steamships were being built in England. In the foreign carrying trade full reciprocity was at once granted, however, in accordance with the established policy, and it was naïvely believed for a time that the American shipping industry could effectively compete with the British marine under the new con-

ditions. In contrast, despite the promises conveyed by George Bancroft, the American minister at London, to Lord Palmerston, the government refused to open the coastwise carrying trade to foreign ships.[70] The British, however, continued the liberal trend of their policy by opening the coastwise trade of the United Kingdom in 1854.[71] This American monopoly, which covered many important sea routes including that to California and one leg of the cotton triangle, subsequently became the chief stronghold of the merchant marine. The policy was, therefore, opportunistic, and from some viewpoints was irrational, for it made a distinction between foreign and coastwise navigation and tended to lower costs of shipment in the former and raise them in the latter. It also protected the shipbuilders, but left the owners engaged in foreign commerce without any offsetting protection.

The result of the new policies cannot be accurately measured merely by comparing the rates of growth of the two mercantile marines, as is sometimes done. The British sailing-ship fleet employed in the foreign trade, which was the branch of shipping primarily affected, rose, despite keen American competition, from about 2,040,000 gross tons in 1849, to about 3,029,000 gross tons in 1860, an increase of 48 per cent.[72] It is likely, however, that if protection had been maintained a substantial rise would have occurred because of the expansion of traffic on the routes which would have remained protected. The success of the new policy from the British standpoint lay, instead, in the fact that British ocean communications had been notably improved in efficiency while at the same time the competitive position of the British shipping industry was strengthened. In contrast, the American registered sailing fleet increased from 1,418,072 gross tons to 2,448,940 gross tons during the same period — an increase of 73 per cent — but much of this rise must be attributed to the activity in the protected California trade. The steam tonnage of neither nation was seriously influenced by the repeal at this time. Most important, however, was the fact that the policy of Great Britain had secured for that country a position in the international carrying trades which was to be of great value in the age

[70] Lindsay, *History of Merchant Shipping*, III, 163–166, 212–214.

[71] 17 & 18 Vic. c. 5 (1854); Lindsay, *Our Merchant Shipping*, pp. 28–45. This trade was of minor interest to American owners.

[72] A.R.C.N., 1901, p. 480. The 2,804,610 net tons documented in 1860 were increased by 8 per cent to give the approximate gross tonnage.

of iron and steam, whereas the United States established a policy of rigorous protection of the shipbuilding industry which was largely to nullify all future efforts to rebuild the shipping industry and to maintain American ships in the foreign carrying trades.

8

It now remains to tell the sequel. Between 1857 and 1870 economic conditions and policies combined to produce a serious decline in the American maritime industries. This collapse surprised the shipowners and the public generally, and distressed the government. The factors which produced this decay were, for the most part, elements of the normal process of economic development, and may be listed in the order of their importance as (1) the rise of lower-cost centers of sailing-ship construction abroad, first in Canada, and then in the United Kingdom; (2) the increase in shipbuilding costs in the United States; (3) the diminution and eventual disappearance of the advantages resulting from leadership in design and construction; (4) the collapse of the important California trade; (5) the Civil War, which caused the collapse of the cotton trade and endangered shipping through naval action; (6) the improved efficiency of British and other foreign shipping resulting from legislation and competition; (7) the development of steam navigation; and (8) the navigation policy of the United States.

The extraordinary boom had been caused to a considerable degree, as we have seen, by the extensive construction of ships for the California trade, and the severe depression in this business, which began to develop in 1856 and became very severe in 1857 as the result of the over-tonnaging of the carrying trade, the over-supply of the San Francisco market, and the development of steamship service by way of Panama, was consequently a severe blow to the maritime interests. It was, in fact, inevitable that there should be a sharp reaction from market conditions which could be only temporary, and that freights should fall and the demand for fast vessels cease. Nevertheless, the trade was seriously overbuilt, with the result that many of the leading owners and builders were soon forced into bankruptcy and some of the most famous clipper ships were laid up. By 1856 the California market was completely glutted; consignments, which still continued to arrive, were unsalable; and many of the vessels were

either being allowed to rot at San Francisco or being ordered to the Far East or to New York without opening their hatches. The freight rates, which at the height of the boom had been generally over $25 per cargo ton and had even been as high as $60 per ton in some cases, fell sharply, averaging out of New York $12.75 in 1855 and $11.00 in 1857, and out of Boston $14.31 in 1855 and $8.70 in 1857.[73] At such rates the sharp-lined, heavily-rigged clippers apparently had difficulty in clearing their operating expenses; consequently the construction of such vessels ceased, for on no other routes were adequate freights to be had.

Hence the number of arrivals at San Francisco from East Coast ports by way of Cape Horn declined from a high of 282 vessels totaling 206,279 gross tons in 1853 to 82 vessels totaling 97,000 tons in 1858. The tonnage subsequently increased again, however, to 113,117 tons in 1863 and 110,721 tons in 1867, but this reflected chiefly the rise of the grain trade. Furthermore, throughout the entire period before the Civil War it was difficult to secure cargoes eastbound within the navigation monopoly to New York or Boston. Departures on this route amounted to but 21 ships of 24,242 tons in 1853 and 10 ships of 12,042 tons in 1858. Consequently vessels were generally forced to enter the competitive carrying trades on the homeward voyage, and in these their earnings were relatively low, especially after 1857. The position of the California carrying trade as a powerful economic stimulant was thus undermined, although a substantial amount of tonnage continued to be operated on the route. The majority of the ships used after 1857 were of the more economical medium-clipper model, which had fuller lines and greater carrying capacity, and sailed with smaller crews than the clipper ships.

Later on economic conditions in the trade were reversed. In the 'sixties and 'seventies, as the exportation of grain from California to Europe increased, vessels frequently sailed for California lightly laden or in ballast to load for Europe, and consequently outbound freight rates became even less remunerative. Eastbound rates became, however, quite profitable. By then a new era in the shipping industry was well advanced. Meanwhile the business was very dull.

[73] "Report on the California Trade," by William T. Coleman & Co. of New York, California Merchants, *R.N.Y.C.C.*, 1859–60, pp. 281–282.

In the highly competitive China tea trade, which commonly had formed a leg of the round-the-world voyage of the American clipper ships, the improved efficiency of the British mercantile marine became particularly evident in the late 'fifties and the 'sixties, and adversely influenced American shipping. Vessels sailing with the new teas from Shanghai, Foochow, Swatow, and Hongkong to New York or London were offered premium rates for speed on account of the high prices offered for new teas in those markets. Consequently, these carrying trades now became the chief centers of international clipper-ship competition. For them British shipyards produced in the late 'fifties a new type of clipper ship, the composite vessel, which was constructed of iron and wood, and which quickly superseded the earlier British oak and teak vessels. These ships were constructed with iron frames, beams, knees, and keelsons, oak keels, and teak planking, which was carefully insulated from the iron frames, and were sheathed with copper to prevent fouling in the tropics. The advantages of this type of construction were the relatively low cost of iron frames compared with wooden ones, the avoidance of dry rot, the saving of over 50 per cent in the cost of shaping and erecting the frames, increased internal capacity, a considerable saving in weight, and the avoidance of the serious fouling to which iron sailing ships voyaging in the tropics were subject.[74]

Composite vessels had been built as early as 1835, but the first ocean-going vessel of this type was probably the *Tubal Cain*, 787 tons, which was constructed about 1850.[75] Composite clipper ships were constructed from 1857, when the *Red Riding Hood* was launched at Rotherhithe, to about 1869, when the opening of the Suez Canal caused the transfer of the trade to steamships. These vessels were an improvement on the American models, being smaller, narrower, sharper at the ends, less heavily rigged, and cheaper to navigate, although their passages were about equal to those of the American ships. Especially notable among the English clippers were the *Ariel*, *Taeping*, *Sir Lancelot*, and *Thermopylae*. The last named, which was constructed by Walter Hood & Com-

[74] John Grantham, "On Iron Frames in Combination with Timber Planking in Shipbuilding," *Trans. I.N.A.*, v (1864), 285–286. The cost of erection on the ship *Dilkhoosh* was £1,300, compared with an estimated £2,900 for a similar wooden vessel.

[75] David Pollock, *The Shipbuilding Industry, Its History, Practice, Science, and Finance* (1902), pp. 41–43.

pany of Aberdeen in 1868 and was designed by Bernard Weymouth, has gone down in history as the fastest British-built sailing ship ever constructed.[76] The American wooden clippers found competition with these ships in the tea trade economically difficult after the collapse of the California trade, and hence beginning in 1857 withdrew almost entirely from the British branch of the trade, and to a considerable degree from that to New York as well.[77] Composite vessels were not built in the United States because of the high price of iron, which was partly due to the tariff. Thus, in this case the decline of the American marine was clearly due to the loss of technical leadership and the development of a better material for frames in a foreign country.

In the North Atlantic trades technical improvements and altered cost levels also caused a collapse of the American merchant marine. The sailing packet service, which had been the outstanding achievement of the American shipping industry in this field, declined rapidly in the late 'fifties, became an irregular marginal business in the 'sixties, and disappeared in the 'seventies. To some slight extent the operations of the subsidized Collins and Cunard Lines had cut into the passenger traffic of the sailing ships during the 'forties and early 'fifties. It was the development of the low-priced, iron-hulled, immigrant steamships, however, particularly those of the unsubsidized Inman Line, which drove the American packets into the marginal position. These vessels made possible the offering of a distinctly better service at a lower price. The comparatively long passages, overcrowding, high death rate, and insufficient regulation of living conditions, which were the rule on the American passenger packets, now became adverse factors of great importance.

The late 'fifties were a crucial period. The number of passengers arriving at New York from foreign ports in sailing ships fell from 136,459 or 96 per cent of the total in 1856, to 55,615 or 68 per cent in 1862.[78] The proportion continued to decline until the sailing packets practically disappeared in the 'eighties. The eastbound passenger traffic had largely passed into the hands of the steamship owners by 1860. By 1869, less than 1 per cent

[76] A. H. Clark, pp. 333–335; Lubbock, *The China Clippers*, pp. 274–277.
[77] Lindsay, *History of Merchant Shipping*, III, 419.
[78] "Castle Garden Reports," *R.N.Y.C.C.*, 1859–60, pp. 276–279; 1861–62; 1863–64, pp. 83–84.

of the 56,623 persons departing from New York went in sailing craft, although from Boston, 44 per cent of the 2817 persons still left under sail.[79] The packet-ship owners consequently found it necessary to operate their vessels irregularly, sending them out by way of southern ports, and to crowd in from 600 to 900 immigrants at low rates in the 'tween decks when westbound. Poorly-enforced legislation [80] had been passed in 1847, and had required for vessels operating in the temperate zone at least 14 square feet of deck space per passenger, but the crowding was still severe. In 1848 the continued high death rate caused the passage of an act requiring passenger ships to have one or two large deckhouses, depending on their size, two or more ventilators, a cooking caboose for each 200 passengers, minimum rations of good food and water, and adjustments in deck space for ships having but 4 or 5 feet of head room in the passenger quarters, and providing severe penalties for overcrowding.[81] The regulations had further been improved somewhat in the Passenger Act of 1855, passengers being allowed 16 square feet.[82] The number of passengers to be carried was also limited to one to every two gross tons. Shipmasters were, however, still to be fined but $10 for each death.[83] It is not surprising, therefore, that immigrants soon showed a preference for the faster and safer iron steamships.

The construction of the high-cost packets consequently ceased suddenly, scarcely five being built for the established lines after 1855. After the outbreak of the Civil War the building of the combination cotton and immigrant ships also largely ceased. With the decay of their fleets and the decline of their business, the packet lines then soon lost their prestige and economies of scale, and by 1869 most of them had disappeared. The only survivors, all of which were seriously emasculated, were the Black Ball, Dramatic, and Red Swallowtail lines, the first of which ceased to operate in 1878, and the latter two in 1881.[84] Thus quickly passed into memory the proudest services in the American merchant marine.

The American shipping industry was also displaced from the

[79] R.C.N.T., 1869.
[80] 9 U.S. Stat. 127 (Feb. 22, 1847).
[81] 9 U.S. Stat. 220 (May 17, 1848).
[82] 10 U.S. Stat. 715 (March 3, 1855).
[83] Lindsay, *History of Merchant Shipping*, III, 328–334.
[84] Albion, *Square-Riggers on Schedule*, Appendix II.

important cotton trade as a result of the Civil War and the competition of foreign sailing and steam vessels. American shipping in this trade had been in a particularly strong position in 1860, the peak year before the Civil War, the tonnage under the American flag at New Orleans then outnumbering that of foreign vessels by about four to one.[85] The blockade of the Union fleet quickly reduced exports, however, from 3,535,373 bales in 1859 to 10,120 bales in 1861, and to even lower levels in subsequent years, with the result that there occurred both a cotton famine in Lancashire, 72 per cent of the cotton of which had come from the South, and a severe disruption of the shipping and shipbuilding industry of the North. Many cotton vessels, in some of which southern capital was invested, were therefore sold in England and were permanently lost. Much of the Yankee tonnage engaged in the trade was diverted to other and less remunerative purposes, and the building of new cotton ships ceased. The Civil War thus crippled one of the leading American carrying trades.

The trade subsequently recovered slowly. The tonnage leaving New Orleans in 1865 was but 8 per cent of that of 1860, and the American-flag fleet was but 5 per cent of the former armada. Total exports of cotton to Great Britain did not exceed the volume of 1859 until 1879, by which time foreign ships had secured well over half of the business. The employment in this trade of British iron sailing vessels and steamships increased rapidly and caused American vessels to lose their preference in freight rates.[86] Large iron screw cargo steamships of shallow draft, which could carry big cargoes of cotton very economically, were introduced by British and other foreign owners. The tonnage of the foreign steamships leaving New Orleans consequently rose to 74,689 gross tons, or 26 per cent of all foreign tonnage, in 1870, and to 465,333 gross tons, or 64 per cent in 1880.[87] Practically no American steamships were built for this trade. Competition was encountered also from cheaper Canadian-built sailing freighters, and from American-built vessels which had been sold in England and could be more cheaply navigated under the British flag than under the American. American shipping thus never recovered its former strong position in the cotton trade.

[85] R.C.N.T., 1860.
[86] Statement of Ambrose Snow, shipowner, Lynch Report, p. 4.
[87] R.C.N.T., 1870, 1880.

In addition to these specific instances, the collapse was due to a general deterioration in the economic position of the American square-rigged marine. This deterioration was aggravated by the Civil War. In general, high and rising operating costs under the American flag, most of which were the result of normal economic developments, made competition difficult, while the reciprocity policy, which by 1860 had been extended to thirty nations, left open nearly all branches of American foreign commerce to foreign ships. Consequently American vessels were forced out of the indirect carrying trades abroad at an early date, and in the general cargo business out of American ports, which was still mainly carried in sailing ships, they were forced to meet strong competition. Foreign steamers also controlled the steamship routes. Thus in many respects the economic situation had greatly deteriorated.

The stimulating influence of the fishing business was also largely lost in the West Indian business. The owners of fishing vessels, who were in competition with Canadian and European firms, felt the restrictive influence of the registry law even before the 'thirties. Vessels were more cheaply built in the many fishing towns of Nova Scotia out of local woods and duty-free iron and other material than in Gloucester, Essex, Cohasset, and Scituate.[88] Outfits were also more cheaply secured. Hence the foreign fish markets of Europe were largely lost to Canadian, English, and French vessels by 1835, and even the sales in the West India markets were curtailed.[89] The old West India trade consequently began to die. Even the bounties of $3.50 to $4.00 per gross ton per year, which were first established in 1789, failed to bring the fishing industry back to its former important position.

The Civil War itself mainly intensified the crisis temporarily by disrupting the cotton trade, causing a danger of loss because of the activities of southern privateers, and for the time being bankrupting and disorganizing the shipping industry. It was, therefore, in no sense a vital factor,[90] although the loss of 239 vessels totaling 105,000 gross tons greatly undermined confi-

[88] R. D. Cutts, *Report on the Commerce in the Products of the Sea* (1872), Senate Exec. Doc., no. 34, 42 Cong., 2 Sess., pp. 30–31.

[89] Raymond McFarland, *A History of the New England Fisheries* (1911), pp. 166–168; Sabine, *Report on the Principal Fisheries of the American Seas*, p. 176.

[90] Statement of A. A. Low, prominent New York shipowner, Lynch Report, p. 44.

dence[91] and caused a rise of war risk premiums to as high as 10 per cent in 1863.[92] The primary damage of the war occurred through the loss of whatever economies of large-scale enterprise existed, the precipitate decision of many owners to abandon the industry or to invest in foreign ships, and the inadequate attention given to navigation policy during what proved to be a critical period in economic history.

As a result of the war and of general conditions, which were favorable, sales of vessels to foreign ownership, chiefly British, reached extraordinarily high levels during the war. From 17,418 gross tons in 1860 they rose to 117,756 gross tons in 1862, to 222,199 gross tons in 1863, and to 300,865 gross tons in 1864, after which a decline set in. The total sales for the five-year period, 1861–1865, totaled 801,301 gross tons, compared with 247,042 tons during the active years 1854–1858, and were exceeded by the total output of sailing ships by only 211,694 tons.[93] In part these sales were due to the offering of new freighters at attractive prices on foreign markets, but to some extent they represented the transfer of fixed capital to foreign flags for permanent operation, or the actual liquidation of shipping enterprises. Many firms, by acting as charterers or agents, continued to operate their sailing ships under the British flag or some other — an arrangement which they found economical and satisfactory. This episode thus marked the beginning of a large migration of American capital into foreign vessels, a movement which the government could not readily prevent, and which in view of existing policies and conditions was economically desirable.

The net result was that the American proportion of the tonnage entering and clearing in the foreign trade fell from an average figure of 67 per cent during the period 1855–1859 to 62 per cent in 1863, and, following intense activity by the Confederate cruisers, to 46 per cent in 1864. After the War the figure fell to 44 per

[91] Nimmo Report, p. 9. The losses by years are as follows:

Year	*No.*	*Gross Tons*
1861	37	11,789
1862	35	12,790
1863	97	51,710
1864	36	14,122
1865	34	14,194

[92] *R.N.Y.C.C.*, 1862–63, p. 170.

[93] A.R.C.N., 1901, p. 586.

cent in 1866 and to 38 per cent in 1870.[94] The total foreign tonnage entering and clearing more than doubled during the decade, rising from 4,977,916 gross tons in 1860 to 11,332,095 gross tons in 1870, whereas the American tonnage declined from 12,087,209 gross tons to 6,992,967 gross tons. During the same period the American fleet employed in the foreign trade declined from 2,379,396 gross tons to 1,448,846 gross tons; that in whaling, which was a declining industry, from 166,841 gross tons to 67,954 gross tons; and the entire registered sailing fleet from 2,448,941 gross tons to 1,324,256 gross tons. Great, indeed, was the collapse!

Thus a revolution was wrought in the economic position of the American maritime industries, which although sudden, and hence distressing to contemporaries, was inevitable. The year 1863, the first year in which the proportion of the commerce carried in American vessels, as measured by value, fell below 50 per cent, is therefore a convenient date line. In the following year the American proportion of the tonnage entered and cleared in foreign trade also fell below 50 per cent for the first time. This change was, in a sense, the product of the reciprocity policy, for extreme protectionism, though disruptive of commerce in general, would have guarded both industries against some of the changes which occurred. But it can scarcely be argued that the general course of change was fundamentally undesirable, for the United States could scarcely afford to provide all of the timber, iron, capital, technical labor, and workmen required for its marine transportation in the new age.

[94] A.R.C.N., 1901, p. 494.

CHAPTER XI

WOODEN AND IRON STEAMSHIPS AND THE RISE OF THE SUBSIDY PROBLEM, 1838–1862

I

It is now necessary to return and examine the problems connected with steam navigation, with especial emphasis on developments in the foreign trade. The technical developments which produced the ocean-going steamship caused fundamental changes in the organization of the shipping industry of the world, and as a consequence raised important questions regarding public policy. In the sector of sailing-ship navigation, where an approximation to perfect competition prevailed, simple forces governing the supply price of shipping enterprise in each region and nation determined the result, as has been indicated. Such regulations as were placed in effect were comparatively simple in their operation in this world of competitive business. Navigation monopolies raised the price of shipping services until the average costs of the protected fleet were covered. Protective registry laws increased the supply price of tonnage to national shipowners. Regulations affecting the labor contract on board ship reduced international competition in the market for maritime labor and created various national levels of manning costs. The conditions requisite for the continuation of this competitive organization were the absence of economies of large-scale organization, the preservation of competition in the freight and charter markets, and the survival of the free, flexible system of tramp shipping and private trading which was typical of the shipping industry in the sailing-ship period. From the very beginning, however, different economic conditions arose in the sector of steamship navigation, and they became more distinctive as time passed. Therefore the assumptions on which a policy of laissez-faire could be based were soon found to be absent. Hence instead of treating the shipping and shipbuilding industries as ordinary competitive businesses not particularly affected with a public interest, as formerly, it became necessary for governments to grope their way toward national

ocean transportation policies and to place the steamship operators, like the railroad operators, in a special position. These new policies were not fully developed in the United States, however, until the twentieth century.

The important changes which occurred in the economic conditions under which the maritime industries operated as a result of the development of steam navigation may be listed as follows. First, in shipbuilding the number of independent firms capable of constructing ocean-going ships diminished because of the increase in the size of the individual enterprise, with the result that competition became imperfect, the speculative construction for the market practically ceased, the existence of large overhead costs produced cut-throat competition at times, and collusion in bidding or more formal monopolistic activities became possible. In the United States, in shipbuilding, conditions favorable to monopoly became particularly pronounced. Second, the supply of shipbuilding materials and parts, such as steel, boilers, engines, turbines, propellers, and generators, was secured more and more from industries in which conditions of monopolistic and imperfect competition prevailed, and in which policies of price discrimination were likely to be found. Under such conditions, the integration of shipbuilding concerns with the steel producers and other firms was the natural tendency. Third, large economies of operation arose in the shipping industry, with the result that policies of expansion and combination were adopted which led to the domination of ocean traffic by huge organizations. As in the railroad field, free competition among a small number of firms soon led to rate wars, which in turn led to the formation of private control devices. These were generally known as conferences, and were monopolistic in character. Rate structures hence tended to become more inflexible, and excess capacity in the industry became an important problem. Fourth, the operation of expensive vessels on schedule on fixed routes raised the problem of overhead and joint costs in rate-making. Fifth, the whole situation was made even more complicated by the rivalry of the great powers whose transportation, trade, and naval policies were frequently in conflict. Thus in the sector of steam navigation a new maritime economy arose.

It is important, therefore, to recognize that the transition from sail to steam was of considerably greater significance than that

from wood to metal. The latter change produced no remarkable alteration in the organization of the shipping industry in the sailing-ship trades. Even the subsidies which were given to metal sailing ships were of the general navigation-bounty type. The former, however, almost from its beginning, effected changes in the conduct of the shipping business which were strikingly similar to those effected in the overland transportation business as a result of the completion of railway lines. These changes began, it should be noted, in the age of wooden steamships, which age may be said to have ended about 1862. The full development of the new system did not become possible, however, until metal steamships began to appear, for the business of building wooden steamships, like that of building wooden sailing ships, was conducted under conditions of increasing costs, and consequently it was undertaken by comparatively small-scale enterprises. Likewise, that of operating wooden steamships was limited in its growth and scale of operations by the high costs of navigation resulting from the technical and economic difficulties encountered in building vessels of considerable size and power out of wood. The outlines of the new system of ocean transportation were laid down, nevertheless, during the period of wooden steam vessels.

2

Until 1838 steam navigation was, on the whole, distinctly subsidiary to sail navigation, especially in the United States, where distances in coastwise and foreign trade were comparatively great and good coal supplies were not easily procurable in many places. Steam vessels were consequently employed on routes on which, for some reason, sailing craft did not perform satisfactorily. In the United States they were used chiefly in the river navigation in which the great distances, currents, variable winds, and obstacles to horse-drawn barge navigation were serious difficulties. In Europe they were used in the short-voyage coastwise carrying trades and for towing in the canals. In the off-shore foreign and coastwise trades, however, no steamship could effectively rival in economy, durability, and general performance the rapidly improving sailing ships of that period.

The steamship was not, strictly speaking, an invention, but was rather a synthesis of existing inventions. The fact that many innovators were at work at the same time on the problem of

mechanical propulsion indicates that the major elements of the solution were at hand. The primary innovations had been the invention of the steam engine by James Watt in 1769, the discovery of the puddling process for the manufacture of malleable iron by Cort in 1784, and the development of machines by Samuel Wilkinson and other iron masters to fashion accurately the parts of engines. In the last quarter of the eighteenth century it was possible to purchase crude but workable steam engines from the firm of Boulton & Watt at Soho. Such a machine was, in fact, purchased by Fulton and installed in the pioneer ship *Clermont*. The primary problem remaining was to transmit effectively to the water the power generated. This task was at first accomplished by the use of the paddle wheel, a fairly simple device, which was used by John Fitch and other early workers.

The primary task of the steamship builders of the early nineteenth century was, therefore, to perfect and adapt the designs and methods of construction of vessels and engines to the requirements of various steamship services and to the economic conditions controlling production. The chief problems were the development of more accurate machinery for making engines, especially for boring cylinders, the creation of a scientific body of designers and draftsmen, the strengthening of wooden hulls to withstand the weight and thrust of the engines, the modification of the lines of the hulls to provide a more easy and economical passage through the water, and the achievement of higher levels of economy in the use of fuel and water. In each of the important leading maritime nations the solution of these problems was conditioned by the general economic situation in that country.

In the United States the development of steamships was closely associated with river navigation, especially that of the Hudson. Nearly all of the early work, indeed, centered around river-boat construction. Although there is some doubt regarding priority, it appears that among the first builders was John Fitch, a Philadelphia mapmaker, who succeeded in 1786 in installing a small steam engine in a boat and in operating it, and in the following year in constructing a 60-ton steamboat.[1] Subsequently he operated a ferry between Philadelphia and Burlington. There were, however, a large number of other experimenters. One of these, John L. Stevens of Hoboken, deserves considerable attention because of

[1] C. G. Jackson, *The Ship Under Steam* (1927), pp. 22–26.

his efforts to use screw propulsion in a small launch in 1802. He was forced to abandon this effort for lack of proper tools,[2] but he continued to construct steam tugs at both Hoboken and Bordentown where he had yards and shops. In 1807, however, there appeared on the Hudson a paddle-wheel vessel of substantial size, the *Clermont*, measuring 130 feet in length, 16 feet in beam, and only 7 feet in draft, which was built under the direction of Robert Fulton at the yard of Charles Browne on the East River and was fitted with an engine made by Boulton & Watt at Soho which gave her a speed of about five knots.[3] Fulton was a Philadelphia draftsman who had been considering steam navigation since about 1793 and had secured the support of Robert R. Livingston, a New York capitalist. The latter in 1798 had obtained a twenty-year monopoly of steam navigation within the State of New York. Both were familiar with European steam engines and steamboat experiments. Fulton's contributions, therefore, were the synthesis of the various innovations which had been made up to that time and the establishment of the first monopolistic steamship service. The initial voyage of the *Clermont* to Albany was made on August 17, 1807, and required but thirty-two hours. The ship in fact proved to be reasonably successful. The owners subsequently enlarged the *Clermont*, and also added several other vessels to their line within the next few years. The monopoly finally fell, however, as a result of the competition of the Vanderbilt steamers and the noted Supreme Court decision of Gibbons & Ogden of 1824, under which the attempt of a state to regulate interstate navigation on inland waters was declared unconstitutional. By then a highly competitive steamship business was arising on the American rivers.

During the ensuing half century the businesses of building and operating steamboats on the sounds, lakes, and rivers thrived. Indeed the United States took the lead in the construction of vessels for such service, for in no country were there such excellent inland waters and protected bays and sounds. Prior to the development of the railway network steamboats provided the only fast, regular, and economical service on many of these routes. Furthermore, the business came within the protection of the navigation

[2] C. H. Cramp, "The Evolution of Screw Propulsion in the United States," 2 pts., *Trans. S.N.A. & M.E.*, vols. XVII–XVIII (1909–1910), pt. 1, p. 145.

[3] D. L. Buckman, *Old Steamboat Days on the Hudson River* (1907), pp. 10–11.

monopoly, and hence the competition of lower-cost foreign vessels was not to be feared. On the Hudson in particular, which was well suited for steam navigation owing to its 150 miles or more of navigable length, deep tidal channel, moderate current, and supply of hardwood fuel, the heavy traffic in passengers, express, and freight between New York and the West produced an extraordinary development of both passenger liners and river tugs.[4] Consequently, the principal builders and engine shops were located on its lower reaches until the development of iron hulls shifted the localization of construction to the Delaware. There was also extensive steam navigation on the western rivers, but the extremely shallow draft required, which resulted in the use of the flat, broad, sternwheel type of design — a type quite useless at sea — made the development there of minor significance. Hence in an analysis of the development of American deep-sea steam navigation the conditions prevailing in the eastern building centers alone are important.

The American marine engineering industry was technically backward during much of this period because of the late development of the machine-tool industries in the United States. It soon became evident, indeed, that heavy industry was as essential for the builders of iron ships and steam vessels as forests were for the builders of wooden ships. Although the importation of engines from Great Britain was possible, the costs of shipment and the establishment of duties made such action uneconomical. The tariff on manufactures of iron, including engines, stood at 25 per cent from 1833 to 1837, at 23½ per cent in 1838, 30 per cent under the Act of 1846, 24 per cent under the Act of 1857, and 30 per cent under the two acts of 1861. Hence the machinery of most vessels was made by domestic producers. Until the 'thirties these were generally marine blacksmiths whose business consisted of the production of forgings and castings for both sailing and steam vessels and of general repair work.[5] Some styled themselves "marine engineers," but since the construction of engines, like that of many sailing vessels, was mainly by rule of thumb, there was little scientific study of engineering. The

[4] See J. H. Morrison, *History of American Steam Navigation* (1903), for a good account of this development.

[5] Holbrook Porter, "The Delamater Iron Works, the Cradle of the Modern Navy," *Trans. S.N.A. & M.E.*, XXVI (1918), 1.

engines which were built were of simple construction, and were predominantly of the walking-beam design. The cylinders were frequently poorly bored because of the lack of proper drills, planers, and milling machines and the absence of skilled workmen.[6] All parts were generally made by hand.[7] Boilers were usually of copper, hand-punched and riveted, and frequently gave way under pressure with disastrous consequences. Not until the late 'forties and 'fifties, in fact, did the business of some of the shops warrant the purchase of improved machine tools in foreign countries. Builders also complained that the supply of well-trained skilled machinists was also extremely limited.[8] Thus the American marine engineering industry was distinctly inefficient, amateurish, and poorly equipped during the first third of the century. In some respects, indeed, it was an infant industry which might have been expected to improve technically and economically under a sufficient stimulus. That provided by tariff protection was hardly sufficient, however, and until the middle 'forties the government was not prepared to go further.

The result of the state of the marine engineering industry and the dominance of river-boat construction was that American steamboats were extremely inefficient. Until late in the 'thirties, in fact, firewood, which was secured at nearly every stop and was relatively cheap, was used as fuel by both river and sound vessels.[9] Furthermore, condensers were rarely employed, and it was therefore necessary to renew the water supply frequently. American steamboats were thus poorly designed for continuous non-stop operation far from bases of supply — a fact which seriously hampered the development of ocean-going craft. The vessels themselves, however, reached great size and magnificence, those on the Hudson having many decks and great length. The traditional full ends of sailing vessels were completely discarded in favor of sharp lines forward and aft, and hence relatively high speeds were secured. The hulls, which were of oak and southern pine and required special staying by means of high fore-and-aft girders and other devices, were generally built in yards which specialized in this type of work. Propulsion was almost exclusively

[6] C. H. Haswell, "Early Marine Steam Engine Construction and Navigation in the United States," 2 pts., *Trans. I.N.A.*, XL–XLI (1898–1899), pt. I, p. 105.
[7] Haswell, pt. I, p. 105; pt. II, p. 89.
[8] Cramp, "The Evolution of Screw Propulsion," pt. I, p. 145.
[9] Haswell, pt. I, pp. 108–109.

by means of side paddle wheels, which the New York builders made of great size and mounted in huge paddle boxes. So successful, indeed, were the New York builders with the paddle wheels in the Hudson River trade that they refused to recognize the advantages of the screw long after it had been widely accepted in Europe and at Philadelphia.[10] The progress made in the design and construction of river boats was of small assistance, however, in the development of ocean-going vessels.

It is significant that American shipowners and builders failed to make comparable progress in the development of ocean steam navigation. This may be attributed both to the technical backwardness of the designers and builders and to the comparatively high cost of steam vessels. Most of the early American ocean-going steamships were employed as packets in the coastwise trade. The majority were small craft which were used in distinctly short-voyage services in which efficiency was of comparatively minor importance. By 1830 there were a large number of such vessels in service on Long Island Sound, Massachusetts Bay, and the Chesapeake.[11] In the longer-voyage coastwise trades the only serious attempt to operate steam vessels, which proved to be a financial failure, was made by David Dunham, who placed the 702-ton auxiliary ship-rigged vessel *Robert Fulton* on the run from New York to Charleston, Savannah, and New Orleans in 1820. Like all auxiliaries of this period she had neither the economy of a sailing ship nor the speed of a full-powered steamship, and hence proved to have insufficient earning power, with the result that she was withdrawn and sold after three years of operation to the Brazilian government, which removed her engines.[12] No further operations on this route were attempted until 1834, when a new line to Charleston was established by James P. Allaire, one of the leading builders of marine engines. His vessels, however, and those of the later lines as well, proved to be structurally weak, and in addition difficulties were encountered with the machinery and boilers. No vessels of efficiency and economy comparable to the small English coastwise liners and iron screw colliers were then being built in the United States.

[10] Cramp, "The Evolution of Screw Propulsion," pt. 1, p. 154.

[11] See F. E. Dayton, *Steamboat Days* (1925), pp. 18–22, 98–114, 159–330.

[12] G. H. Preble, *A Chronological History of the Origin and Development of Steam Navigation* (1883), p. 106.

The voyage of the 380-ton auxiliary paddle-wheel steamship *Savannah* to Europe in 1819 again indicated the same weaknesses. This ship was built by Fickett and Crockett at New York in 1818 and was financed by some foolhardy, though enterprising, Savannah capitalists. She reached Liverpool after a long passage from Savannah of twenty-nine days, and of this time she was under steam but little more than three days.[13] After her return voyage from Russia by way of Norway, which required twenty-five days, she was sold for service as a sailing ship. The experiment, which ruined her chief owner, William Scarborough, showed that greater size and power, increased efficiency, and lower first costs were essential for oceanic steam navigation.

Prior to the appearance of the subsidized ships in the 'fifties the relatively high cost of American-built steamships in comparison with sailing vessels, and their inefficiency, caused American shipowners to abandon efforts to use steamships on the ocean routes except in the short-voyage bay and sound services. The impressive amount of American steamship construction consisted almost exclusively of river boats, and the majority of these were for service on the western rivers. Of the 1963 steamships built in the United States during the fourteen years from 1836 to 1849, only sixty-two were registered while 1901 were enrolled.[14] Of the enrolled vessels only 441 were built on the seaboard.[15] As late as 1847 the registered steam tonnage of the United States amounted to but 5631 gross tons.[16]

In the East the building of steamboats was centered at New York because of the Hudson River trade. The majority of the engines were built there by a limited number of small firms, of which the Allaire Works, Novelty Works, and Hogg & Delamater were the most important. Shipbuilders and engineers there were chiefly familiar with the light, fast, inefficient Hudson River paddle boats. Hence on the eve of America's entry into international competition with ocean mail steamers neither builders nor engineers had had much experience with this type of vessel.

3

Conditions were somewhat more favorable for the growth of ocean steam navigation in Europe, especially in Great Britain,

[13] Jackson, pp. 73–74.
[14] R.C.N.T. for the years named.
[15] R.C.N.T. for the years named.
[16] R.C.N.T., 1847.

where industrial change had progressed most rapidly. The industrial basis of a strong steamship-building industry was at hand in the growing iron industry, the rising machine shops in which precision tools came into use, and in the increasing supply of specialized skilled labor.[17] The early development of steam navigation occurred nearly simultaneously with, although independently of, that in America. At about the time that Fitch was at work the engineer William Symmington was engaged on the same problem in Scotland with the result that several small craft were built by him and operated on Dalwinston Loch and the Forth and Clyde Canal, the first run being made in 1788.[18] His patron, Patrick Miller, found it necessary to withdraw his support, however, and hence it was not until 1801 that Symmington was able to build a commercial vessel, the *Charlotte Dundas*, a sternwheel tug for use on the Forth and Clyde Canal, of which Lord Dundas, his new patron, was an important shareholder. This vessel, which was the first practical steamboat, made a successful trial run with two barges in tow in 1802.[19] At about the same time Henry Bell, also a Scotchman, conceived certain ideas regarding steam navigation which he imparted first to the British government in 1800, and on being rebuffed, to others, including that of the United States. He subsequently had built in 1812 by John Wood[20] of Port Glasgow a small 40-foot steamboat, the *Comet*, which had a small four-horsepower engine with side paddle wheels. This boat performed satisfactorily as a local packet and excursion boat on the Clyde and Forth for several years. Bell and Fulton were in correspondence and were acquainted with each other's work, as well as with that of Symmington. The development of the steamship in both countries was thus similar. Thereafter, however, marked differences were to appear owing to the variations in the geographical and economic conditions between the two countries.

The years between the launching of the *Comet* and the transatlantic voyages of 1838 were taken up with the improvement of steamship design, engines, and propelling mechanisms, a work

[17] C. R. Fay, *Great Britain from Adam Smith to the Present Day* (1928), pp. 256–259.

[18] Lindsay, *History of Merchant Shipping*, IV, 35.

[19] Lindsay, *History of Merchant Shipping*, IV, 37.

[20] J. S. Russell, "John and Charles Wood, Naval Architects," *Trans. I.N.A.* II (1861), 141–148.

which was pursued with vigor by shipbuilders and designers, and with the establishment of short-voyage ocean steamship lines and the development of a public policy with regard to such services. British shipowners and shipbuilders soon found that, because both iron and machinery were relatively cheaper in Great Britain than in the United States and the economy of British engines was greater, it paid to substitute steam vessels for sailing craft on many packet routes at an earlier date. Therefore the development of small but stout steam vessels for the trade of the narrow seas progressed rapidly. The steam tonnage owned in the United Kingdom rose from 34 vessels of 3018 gross tons in 1820 to 153 vessels of 15,978 gross tons in 1825, 298 vessels of 30,339 gross tons in 1830, and 503 vessels of 53,485 gross tons in 1835.[21] All of the chief ports were soon connected by steam packet services. The *Thames*, 70 tons and 14 horsepower, opened the London–Glasgow service in 1815 and successfully met the tests of stormy weather — a feat which had the effect of popularizing coastwise steamships.[22] Services were established between Glasgow and Belfast in 1818, Holyhead and Dublin in 1819, Dover and Calais in 1820, Liverpool and Glasgow, Liverpool and Dublin, and London and Leith in 1822, London and Edinburgh in 1826, Southampton and Havre in 1835, and on several other routes as well.[23] James Wood, the Glasgow shipbuilder, and David Napier, the noted engineer, produced the *Rob Roy* of 90 tons and 30 horsepower, which opened the Channel service in 1820.[24] Napier was instrumental in developing sharp bow sections [25] and surface condensers.[26] British coastwise packets soon reached considerable size, for as early as 1822 James Wood built the geared paddle-wheel steamship *James Watt*, 448 tons and 100 horsepower, and she was followed in 1826 by the barkentine-rigged paddler *United Kingdom*, of even greater dimensions.[27]

These vessels soon displaced the sailing packets which had formerly provided the freight and passenger services on these

[21] A.R.C.N., 1901, p. 472.
[22] Jackson, pp. 60–64.
[23] R. A. Fletcher, *Steamships and their Story* (1910), pp. 71–72; Lindsay, *History of Merchant Shipping*, IV, 77–81.
[24] Preble, p. 105.
[25] Jackson, pp. 67–69.
[26] Preble, p. 105.
[27] Lindsay, *History of Merchant Shipping*, IV, 80–81.

routes. In general, they were organized in small quasi-monopolistic line services. Mail contracts were usually secured in accordance with the British policy of developing communications, and where Admiralty sailing packets had been running these vessels were withdrawn. The General Steam Navigation Company, later to become the primary British firm in this field, was formed as early as 1820.[28] It is thus apparent that by 1830 the development of the short-voyage steamship network was farther advanced in Great Britain than in the United States.

4

The organization of the British network of steamship services continued at an accelerated pace during the ensuing two decades. Progress was rapid in two respects. First, as a result of improvements in ship design and engineering large powerful vessels of 1000 gross tons or more and speeds of from eight to ten knots were developed for overseas service. Secondly, many new lines of steamships were established in both the nearby and overseas foreign carrying trades. Since the more important services soon encompassed a large part of the world, and hence influenced the commerce and shipping of other nations, British policy in regard to steam navigation became no longer of domestic interest alone. Indeed, by 1840 it became of great concern to United States shipping interests.

Although conditions were economically favorable for steamship construction and operation in Great Britain, the state both hastened and guided the development of the network. Some services developed naturally under conditions of laissez-faire because of adequate demand by the public for steam communications. Among these, for example, were many of the coastwise and Channel services on which the traffic was substantial and the early receipts were sufficient to meet the expenses. Some of these services came under the control of the British railway companies[29] and hence became closely integrated with the internal transportation system. New lines also were developed in the carrying trades to France, Spain, Holland, and Germany without any aid. The government, however, was faced with the question of whether or not actively to promote steamship services on the long-voyage routes on which the costs were likely to be heavy relative to the

[28] Fletcher, p. 81.

[29] Fletcher, pp. 102–104.

early traffic receipts. This was the same problem which was also arising in connection with railway development in the United States, Germany, and elsewhere.

The British government made its decision to grant substantial aid about 1836. This action was based on three theories which may be found stated or implied in many of the discussions on the matter. First, the industries of building and operating large steam vessels were believed to be economic infants which if given proper support would expand and develop, and would thus achieve both economies of scale and strong economic positions in the carrying trades. This theory was to a large degree verified in fact by future developments. Second, the state was believed to benefit economically, politically, and in a military way from the resulting improved communication facilities. Put in modern form, this meant that the social value of the service was greater than its market value as measured by the income which owners could collect. Third, the national defense was believed to be strengthened by the maintenance in service of large fast steam vessels. The first steam vessels, the *Comet*, *Meteor*, and *Lightning*, had been added to the Royal Navy during the years from 1820 to 1823,[30] and by 1840 steam was rapidly displacing sail. It was hoped at first that the mail ships would take a place in the battle line, but their role was later changed to that of commerce raiding, transport duty, and the maintenance of normal service. Thus the subsidies were justified on economic, political, and military grounds. The British subsidies were thus granted primarily to produce frequent rapid and regular communications and to maintain a number of high-speed steamships. No effort was made to increase the total merchant marine. Statesmen of the nineteenth century were as yet far removed from the conception of totalitarian war in which the maritime industries as a whole would be part of a huge machine organized for war. It follows that the elimination of foreign shipping was an incidental rather than a primary objective of the policy.

The British government found that the contractual operating subsidy was the most useful device for its purpose. At first a system of government lines operated by the Admiralty appeared possible. For this there was ample precedent, for government packets, both sail and steam, had been employed on various routes

[30] Preble, p. 107.

for some time. It was generally believed, however, that private services conducted under the stimulus of the profit system would provide a more efficient service at lower cost to the government than state ships. The Commissioners on Fees and Gratuities had in fact, recommended the use of contract ships as early as 1788.[31] Hence as fast as possible the Admiralty packets were withdrawn. Under the circumstances then existing this was probably a sound policy.

The first of these contract lines, the Peninsular and Oriental Steam Navigation Company, soon established services to the Mediterranean and Indian Ocean. The managers of this line, Messrs. B. M. Wilcox and Arthur Anderson, who had been ship and freight brokers, had succeeded in 1834 in establishing to the Iberian Peninsula from London a line of steam vessels which competed with the government's sailing packets. The government soon found it desirable, however, to transmit the mails by steam, and furthermore decided to extend the service by means of a grant. Hence advertisements for bids were made, but the usual difficulty in securing a competent competitor of the established firm was encountered. Another concern proved to be the low bidder, but was unable to perform its contract. Consequently the contract was awarded by negotiation to the Peninsular Company, whose first ship to carry the mails, the *Iberia*, sailed in 1837.[32] The agreement provided for a fast weekly service to Iberian ports as far as Gibraltar for the sum of £29,600 ($144,000) per year.[33] In this way the first of the strong British lines was established.

The features which were later to be found in nearly all contracts appeared. Relatively rigid conditions were imposed regarding service, which conditions inevitably increased the costs because of the inability of the contractor to adjust the employment of his tonnage to demand.[34] Effective competitive bidding was impossible to secure, and hence the government had no safeguard against overcharge other than direct negotiation.[35] Finally,

[31] *Report of the* [British] *Select Committee on the Contract Packet Service* (1853), Parliamentary Papers, 1852–1853, xcv, 1. (Hereafter cited as S.C.C.P.S., 1853.)

[32] Lindsay, *History of Merchant Shipping*, IV, 383.

[33] Saugstad Report, p. 219.

[34] Lindsay, *History of Merchant Shipping*, IV, 407–408.

[35] Compare Royal Meeker, *History of Shipping Subsidies* (1905), p. 28. Dr. Meeker held that competitive bidding was the proper procedure.

the inevitable tendency of the government to lean on the contractor for extensions, and of the contractor to rely on the government for continued bounties, thus making the service a quasi-public one, soon became evident. Nevertheless no provision for the control of rates, profits, or accounts was made. The British government preferred this system because the liability was limited, regular communication could be secured, and a rationalization of the service could be more easily obtained under one contractor than under many operators.

The equipment, experience, and prestige of the Peninsular and Oriental Company, as it came to be called, soon became such that it was successful in securing nearly all the additional services which were requested. In 1840 a five-year contract to carry mails monthly from England to Alexandria was easily secured, the government having applied to the Company for a plan. Payment for the first year was fixed at £38,000 ($184,900) and thereafter slowly declined to £33,000 ($160,600) in the fifth year.[36] Three other bidders, who were inexperienced, asked for sums ranging up to £51,000 per year. Two comparatively big vessels, the *Oriental*, 1600 gross tons and 450 horsepower, and *Great Liverpool*, 1540 tons and 464 horsepower, were placed on this run. Further extensions came rapidly. In 1842 the company secured the contract to carry the mail between Suez, Ceylon, Madras, and Calcutta, which agreement, as revised in 1844, provided for a subsidy of £115,000 ($559,600) per year, or 20*s*. per mile.[37] They sent out the *Hindostan*, 1800 gross tons, for this purpose. Another contract line from Ceylon to Penang, Singapore, and Hong Kong was established by the Company at the same time at the rate of £45,000 ($219,000) per year, or 12*s*. per mile. In 1851 the Company also secured for £24,700 ($115,000) per year, or 6*s*.2*d*. per mile, the Suez–Bombay service, which for some years had been inefficiently performed by the East India Company's small steamships.[38] Finally in 1852 the Company secured in addition a contract for a service to Australia.[39] All of these contracts soon came up for renewal, and provisions were then made for vessels of higher speed and more frequent service. Thus by the mid-'fifties the Company from a small firm operating a short-voyage service had risen to the stature of a great

[36] Saugstad Report, p. 220.
[37] Saugstad Report, p. 220.
[38] Meeker, p. 29.
[39] Saugstad Report, p. 221.

chartered company operating fifteen ocean steamers of 1100 gross tons or more and performing interconnecting services stretching from the British Isles to the Mediterranean and Far East.[40] Its size, contracts, and influence provided ready access to capital resources and economies of scale and gave it unprecedented economic power in maritime affairs. It thus became the first of the great national regional navigation companies which were to arise in Great Britain.

The position of this company as the chief government contractor subsequently remained relatively undisturbed. Other potential contractors could scarcely hope to create quickly such a fleet and to compete successfully with the established line in the rate war which would surely have arisen. Although other firms operated vessels more or less regularly in its territory, none could equal its service in speed, reliability, and size of vessels. The state, however, had no simple measure of the amount of subsidy necessary to develop the service properly, for neither the bids of potential rivals nor the performance of unsubsidized vessels gave a reliable indication of future costs and revenues. It seems, nevertheless, that the service was operated with due enterprise and economy, that the payments were not excessive, and that the subsidy brought an infant enterprise into maturity, although the test of abandoning payments was never made. It also appears that it served as a powerful engine to direct the trade of the Middle and Far East to Great Britain. The military value of this fleet was also proved during the Crimean War, when eleven of the ships which were built to mount heavy guns were taken up by the state for service as transports.[41] Thus the British government created a powerful organization of considerable value both in time of war and in time of peace.

By similar means services were established to other ports of the world. For a West Indian service the Royal Mail Steam Packet Company, which had been chartered in 1839, was granted in 1840 a subsidy of £240,000 ($1,168,000), per year for an annual service covering 684,816 miles.[42] This service had previously been performed in part by Admiralty brigs. A fleet of fourteen steamships of 400 horsepower or over to be built under naval inspection were to be provided, and these were to sail twice

[40] Saugstad Report, p. 221.

[41] Meeker, p. 32.

[42] Saugstad Report, pp. 246–247.

monthly to Jamaica, Barbados, Cuba, Panama, and Mexico, and there were to be branch services to the United States. Traffic was light, however, and owing to early financial losses the government soon reduced the number of required sailings substantially, with the result that the subsidy was then at the high rate of $3 per mile sailed.[43] The development of commerce and of operating economies in the line, however, brought profits of considerable amount by 1844. On the renewal of the contract in 1852 the amount of the pay was increased to £270,000 ($1,314,000) per year for a mileage of 547,296, but the rate fell to about $2.40 per mile.[44] Five new vessels of 2250 gross tons and 800 horsepower were built at this time.[45] In addition, the service of the Company was extended to Brazil. In 1857 the Company was further required to reduce the mail time from England to Rio de Janeiro from sixty-two to fifty-five days and to add three vessels of 3000 gross tons and 800 horsepower and a coastwise steamer to carry the mails on to the River Plate.[46] As in the case of the Peninsular and Oriental Line, it was necessary to award the contracts by negotiation. In all of these cases it was necessary for the government to avoid, on one hand, underpayment and failure, and on the other hand, overpayment, fraud, and inefficiency. Although the state may have erred on the side of overpayment, the policy established a second strong monopolistic contractor in the commerce of the West Indies and South America.

A third British corporate concern, the Pacific Steam Navigation Company, was chartered on February 17, 1840, and had a paid-up capital of £94,000.[47] This firm, which was promoted by William Wheelwright, an American shipowner and master, was organized to carry the mails, passengers, and freight along the West Coast of South America from Panama, where a connection with the steamships of the Royal Mail Company was made, as far south as Valparaiso. This was, probably, the most questionable of the large undertakings, for traffic was light, the route long, and the cost of coal, which was carried out by sailing vessels around Cape Horn, was high. The line might have failed, in fact, for during the first five years of unsubsidized operation, beginning in 1840, the company's two 700-gross-ton steamships lost

[43] Saugstad Report, p. 247.
[44] Saugstad Report, p. 247.
[45] Saugstad Report, p. 247.
[46] Saugstad Report, pp. 247–248.
[47] Saugstad Report, p. 250.

£72,000.[48] Furthermore, the service was not vital to British imperial communications. It merely developed the transport relations of the British Isles with a particular region which was then of minor importance. Although British commerce must have benefited somewhat, it is questionable if the general advantage so acquired was equal to the subsidy with which the line was later sustained. The service was supported, although with difficulty, by means of subsidies, beginning in 1845 with payments of £20,000 ($97,000) per year for a monthly service from Callao to Valparaiso. On renewal in 1850 payments of £25,000 ($121,700) per year were granted, and the Company was required to build four 1000-ton ships.[49] The payments were still inadequate to provide profitable operation, however, and hence the British government, which was unwilling to increase the subsidy, allowed reduction in the quality of the service.[50] This was clearly a case of developing a line ahead of the traffic.

The policy of Great Britain as exhibited by these cases, was, therefore, to develop a network of steamship services radiating outward from British ports to nearly all parts of the world to which steam navigation was feasible. It was the equivalent of a world-wide regional railroad network centering at London and Liverpool. The subsidies were designed to provide steamship service where none would have arisen and to increase the number of mail vessels and their size, speed, and power. They also regularized existing private operations, increased the speed and regularity of transit of mails, passengers, and express cargo, promoted the development of large, responsible contractors, and provided high-class vessels for military uses. The policy tended to lower general freight rate levels only slightly, for the mail liners carried but little general cargo and almost no bulk cargo. Much of their business was, in fact, promoted by the improved service. Hence the unsupported shipping industry, in general, was probably not adversely affected to any serious extent. American sailing ships, in particular, suffered but little from this competition. The services mentioned were designed to connect Great Britain with nations and regions which were primarily non-maritime in character, and were, for the most part, readily willing

[48] Saugstad Report, p. 250.
[49] Saugstad Report, p. 251.
[50] Saugstad Report, p. 251.

to accept the benefits of the improved service thus bestowed on them and to use the communications so organized.

The development in a similar manner of steam navigation to the United States, a strong rival maritime nation jealous of its maritime prestige, ocean communications, and naval power, raised problems which were absent in the case of the other British regional services. Hence it is necessary to trace in some detail the rise of British services on this route, the establishment of rival American services, and the resulting economic struggle for the control of the steamship traffic.

5

Effective and regular steam navigation between North America and Europe began in 1838. Earlier voyages, in addition to that of the *Savannah*, had been made by the small 350-ton Clyde-built steamship *Curaçao* to the Dutch West Indies in 1829,[51] and by the clumsy 361-ton *Royal William*, a Quebec-built auxiliary, which made a passage from Pictou to England in five weeks in 1833.[52] Both enterprises were financial failures owing to lack of sufficient power and carrying capacity in the ships and of suitable organization. More formidable plans were soon in preparation, however. It was anticipated in the shipping world about 1836 that the British government would soon establish a direct subsidized steamship service to North America, and plans were consequently laid by several firms to secure the contract.

The leading firm in the field was the Great Western Railway, which hoped to extend its railway service between London and Bristol by steamer to New York. This organization built the *Great Western*, a wooden paddle ship of 1340 gross tons and 750 horsepower, which was designed by the engineer I. K. Brunel, built by Patterson of Bristol, and engined by Maudsley, Sons, and Field.[53] This pioneer vessel, which was 212 feet long, 35 feet in beam, and 23 feet in depth of hold, and was very heavily built, having solidly laid frame timbers and heavy truss work, was laid down on July 28, 1836, and completed in 1838. She sailed from Bristol for New York on April 7th of that year, with seven cabin passengers, and arrived on April 23rd after a passage of fifteen days and ten hours, her average speed being 8.6 knots and her

[51] Preble, p. 117.
[52] Jackson, pp. 79–80.
[53] Lindsay, *History of Merchant Shipping*, IV, 173–174.

coal consumption 655 tons. She had been preceded, however, by the 703-ton coastwise packet *Sirius*, which had been chartered by a rival organization, the British and American Steam Navigation Company. This firm had been promoted by a New York merchant resident in England, Junius Smith, with the aid of the British shipbuilder, MacGregor Laird.[54] This company's large steamship, the *British Queen*, 1862 tons, had been delayed in construction at Blackwall, and hence the decision was made to charter the *Sirius*. This vessel sailed from London on March 28th and from Queenstown on April 4th, and arrived at New York with ninety-four passengers on April 22nd after a passage from the latter port of eighteen and one-half days.[55] Subsequently two small coastwise steamships, the *Royal William* and the *Liverpool*, belonging to another rival, the Transatlantic Steamship Company of Liverpool, arrived. The voyages of these vessels showed that commercial steam navigation was possible on the North Atlantic, and that the passage time of the sailing fleet could be considerably reduced. The British government, therefore, determined to develop a fourth regional contract service on the North Atlantic route to Canada and the United States.

In accordance with its policy on other routes, the British government asked on November 7, 1838, for plans and tenders for a transatlantic mail service on the North Atlantic route. At first the primary emphasis was laid on improving the mail service and imperial communications system between the United Kingdom and Canada. Geography dictated the advisability of continuing the service to Boston and New York, however, for a heavy traffic in mail and passengers might be expected to and from these ports. Furthermore, the latter was the natural gateway to Central and Western Canada.[56] There was, indeed, more justification for giving a promotional subsidy on this route than on many others. The performances of the early vessels clearly showed that financial support was necessary for the time being if regular steam service was to be supplied. One of the pioneer firms, the British and American Steam Navigation Company, which failed to secure a subsidy, was soon in a weak position and in fact collapsed after the loss of its big new steamship, the *President*, in 1841. The Great Western Line, which also failed to secure a subsidy but

[54] Albion, *The Rise of New York Port*, p. 317.

[55] Jackson, pp. 86–97; Fletcher, pp. 138–141.

[56] S.C.C.P.S., 1853, pp. 20–21.

was backed by the railroad, kept running for about nine years, but it apparently achieved little financial success. There was reason for the government to believe, however, that important economies would be achieved by a well-managed firm in a few years if a subsidy was given, and that the resulting benefit to both the United States and the British Empire would be considerable. Furthermore, the favorable reception of the early British steamships at New York and Boston by merchants and shippers reinforced the view that a regular service would be well patronized. The government was also impressed with the advisability of establishing its service in advance of any similar American action. Hence as soon as possible strong action was taken to provide a suitable contract service under the British flag.

The British government, after receiving various proposals, selected as its contractor the partnership headed by Samuel Cunard, who was born in Halifax, had been trained in business in Boston, and had been engaged in the shipping business at Halifax.[57] In this case the position of the British government was more difficult than in the case of the earlier subsidies, for there were several possible contractors in the field. It was found necessary to turn down the first proposals, which were termed inadequate. The Great Western Railway proposed to operate three ships on a monthly service to Halifax for £45,000 per year, and the St. George Steam Packet Company proposed to operate a monthly service to Halifax for £45,000, or to New York, in addition, for £65,000 with ships of 240 horsepower.[58] Samuel Cunard, who had the financial backing of George Burns of Glasgow and David MacIver of Liverpool, both large shipowners, proposed instead to send larger ships on a bimonthly schedule to Halifax and Boston for £60,000 ($292,000) per annum, which was at a lower rate per mile than any of the other proposals. Finally, after a careful scrutiny of Cunard's proposal by Sir Charles Wood, the Chancellor of the Exchequer, and Sir Charles Baring, the First Lord of the Admiralty, the contract substantially embodying the plan was awarded to Cunard on July 4, 1839 by private negotiation.[59]

[57] Albion, *The Rise of New York Port*, p. 322.

[58] Meeker, p. 5.

[59] Statement of Samuel Cunard, *Report of the* [British] *Select Committee on the Contract Packet Service* (1849), Parliamentary Papers, 1849, XII, 133. (Hereafter cited as S.C.C.P.S., 1849.)

There was much criticism of this action.[60] Charges of favoritism arose, and the government was hampered by lack of adequate standards of costs and revenues. According to Cunard, the only other proposal then made for this particular service required a sum of £130,000,[61] although the Great Western Company later offered to do it for the same sum as Cunard. The decision, although in some respects unfair to the Great Western Company, did, however, prevent a tie-up between a particular railroad and a major mail contractor. The public interest clearly required the use of considerable judgment in making the award. The government, on one hand, had to be careful not to underestimate the sums needed or to allow the contractor to do so, lest the enterprise fail as did that of the American Collins Line which was afterward established. On the other hand, it was bound to see that the money was carefully spent and that the service was efficiently conducted. Presumably the government reached the conclusion that the Cunard proposal met the requirements most satisfactorily, although the claims of the Great Western Line were particularly strong, and indeed received recognition in the Parliamentary inquiry of 1846.[62] The government might even have subsidized two or more lines, or have given a general navigation bounty available to all owners whose ships qualified, although the latter policy would have produced very different results. The policy chosen, namely that of creating a quasi-monopolistic contract service, for such in fact was the Cunard Line, was probably the wisest, however. Traffic was thin, and a division of the business would probably have prevented the achievement of substantial economies of scale, and would have inevitably produced cut-throat competition. Furthermore, the competition of a rival American line was definitely anticipated. The policy of the British government was well chosen, therefore, in the light of its objectives.

Operating under the seven-year contract so acquired, the Cunard Line, which was initially capitalized at £270,000, built on the Clyde four paddle steamships of about 1150 gross tons each, which were equipped with side-lever engines of about 300 horsepower built by Robert Napier, then one of the foremost

[60] Meeker, pp. 6–7.
[61] S.C.C.P.S., 1849, p. 133.
[62] *Report of the* [British] *Select Committee on Halifax and Boston Mails* (1846), Parliamentary Papers, 1846, vol. xv, no. 563.

marine-engine builders in the world. The *Britannia*, the first of these ships, went out to Boston in 1840 on her maiden voyage in fourteen and one-third days, carrying 115 passengers, and the others, the *Acadia*, *Caledonia*, and *Columbia*, soon followed. In 1841, as a result of lobbying activity for a subsidy in the United States Congress, the Cunard subsidy was increased to £80,000, and in 1843, as a result of the subsidy, two larger vessels, the *Hibernia* and the *Cambria*, were added to the fleet. In 1846, the subsidy was again increased to £90,000 ($437,400) per year, although it was later reduced to £85,000 due to the abandonment of a connecting service which had been operated on the St. Lawrence.[63] In 1848, when the establishment of an American line appeared to be imminent, the Cunard Line, with the full support of the Admiralty, secured the adoption of a plan for a weekly service for the sum of £145,000 ($705,600).[64] Under this arrangement the ships sailed directly to New York on alternate voyages, and plans were made to drop the calls at Halifax, which were unremunerative. Two additional vessels were added under this agreement. By 1849, the Cunard Line was making forty-four voyages per year, covering about 272,800 miles at an average rate of pay of about 10*s*.6½*d*. per mile.[65] It also was conducting a connecting steamship service to Bermuda.[66] Its patronage was substantial, the number of persons arriving at Boston during the six years from 1841 to 1846 being 8539, and at Liverpool 7657.[67] Its mail contracts gave it a steady source of income, a regularity of service, and a prestige which its few competitors could not equal. The rival British line operating the *British Queen* and the *President* collapsed with the loss of the latter in 1841.[68] The Great Western Company's ships, supported by the railroad and the hope of an eventual subsidy, continued to run; but although there were occasional rate wars they failed to provide substantial competition. Such did not arise, in fact, until the establishment of the Inman and Collins Lines in 1850, by which time the Cunard Line was in a strong position.

[63] Saugstad Report, p. 234. [64] Saugstad Report, p. 234; Meeker, p. 7.
[65] Statement of Samuel Cunard, S.C.C.P.S., 1849, p. 136.
[66] Statement of Samuel Cunard, S.C.C.P.S., 1849, p. 135.
[67] *Letter from the Secretary of the Navy Transmitting Information in Reference to Mail Steamships* (1852), House Exec. Doc. no. 91, 32 Cong., 1 Sess., p. 21. (Hereafter cited as the Graham Report.)
[68] Jackson, pp. 98–99.

The United States government was thus faced on the eve of the repeal of the British navigation laws with a rapidly developing system of British ocean-steamship services radiating from the British Isles in all directions and operated on a regional basis by contractors of considerable financial strength, size, and experience. The total payments made by the British government and colonies for its support had risen from £170,360 ($829,057) in the fiscal year 1840–41 to £759,664 ($3,696,905) in the fiscal year 1849–50.[69] In the latter year the British West Indian service received £240,000; the transatlantic service to Canada and the United States, £145,000; the Mediterranean services, £25,560; the services via Suez to India, China, and Australia, £285,000; the line on the West Coast of South America, £20,000; and the local European services, £35,000.[70] On these lines a large number of powerful steamships suitable for war service were being operated. Valuable economies, experience, and prestige were being secured both in the construction and in the operation of these vessels. Rate structures were being built upon a monopolistic basis after the manner of those of American railroads, although the distortions from competitive levels were limited to a greater extent by actual and potential competition. These services, by improving transport relations between England and the areas touched, had an active influence on the localization pattern of world trade rather than the passive effect of tramp sailing vessels. It was, therefore, a matter of some importance to the United States that the ocean transportation was being so organized with its hub in Great Britain. Problems of prestige, unfair competition, and naval preparedness were also involved.

6

The development of the British contract service network raised the problem of the proper American policy in respect to steam navigation. Four courses were open to the American government: it could adopt an attitude of laissez-faire toward British and other foreign subsidized lines; it could adopt the restrictive policy of opposing them, as far as possible, by means of countervailing dues and duties; it could supplement them by means of well-chosen subsidized lines; or it could rival them by means of countervailing subsidies designed to check the growth of the foreign services

[69] A.R.C.N., 1901, p. 179.

[70] A.R.C.N., 1901, p. 179.

and to warn foreign governments against undue encroachment on the field of operation of the American merchant marine. The first policy would have enabled the country to benefit through improved service maintained at the expense of the British taxpayer; but great uneasiness was felt because of the active localizing influence of the British network, the possibilities of discrimination, the possible disruptive effects of a withdrawal of vessels, and the maintenance of so many potential war vessels in service; hence at this time the United States was unwilling to adopt a policy of laissez-faire. The second course of action was not feasible, for it would have denied the country the benefit of improved service and would have conflicted with the reciprocity policy. Hence the government was left with a choice between supplementing and rivaling the British system.

The policy of supplementing the foreign services was under the circumstances the most sensible policy, as it was the desire of the government to improve communications, avoid unnecessary expenses, rationalize the services, and preserve for American enterprises a place in the new world shipping network. The economic history of steam navigation, and more recently of air navigation, has shown that the competition of strong rival state-supported lines is wasteful, and that if each side is determined to prevail in the long run it produces an impossible situation in the absence of public or private agreements to control competition. Nevertheless, although the American network proved to be partly supplementary to the British, the general policy of the American government was to set up strong rival lines. Furthermore, these rival services were not efficiently organized. Indeed, although service considerations were sometimes given precedence, the desire to secure a place in particular carrying trades and in steam shipping activity in general was an important force behind American policy. It has remained so to the present day.

It is necessary to distinguish between the subsidies given to lines operating in competitive foreign carrying trades, to those in non-competitive foreign carrying trades, and to those in the protected coastwise carrying trades. With the exception of the North Atlantic service to the United States, the British regional contract system was developed mainly on routes leading from Great Britain to non-maritime foreign nations and to the British colonies, and until 1849 the vessels so employed were, to a large

extent, protected by the British navigation laws from the competition of steamships of the United States or other European nations. The demand of the government and business community in England for regular, fast communication lines was one of the primary causes for their establishment.[71] The American contract system, reflecting the spirit of rivalry which caused its establishment, was not organized, however, with the same emphasis on world-wide communication. Instead, the primary emphasis was laid on the lines operating in the highly competitive services to Liverpool, Southampton, Havre, and Bremen. Only on the non-competitive route to the new territories of California and Oregon by way of Panama was the improvement of communication a primary objective. Indeed, although a line was established from San Francisco to China in 1865, and from New York to Brazil in 1864, no vigorous effort was made until 1920 to organize regional services operating from East Coast ports to the Baltic, Mediterranean, South Atlantic, and Caribbean Seas, where little foreign-liner competition would have been found.

The Congress passed a law on March 3, 1845, directing the Postmaster-General, following the practice of the British Lords of the Admiralty, to contract for the carriage of the mails to foreign countries.[72] The government in this case was actuated more by the desire to establish services subject to its control in competition with the British than by a desire to improve communications as such. Great reluctance to accept the benefits of the British subsidies was shown, in fact, although these benefits were widely appreciated. Fear that the British lines would exact high rates for the carriage of mail and passengers was widespread. There was also some uneasiness because of the control over American communications which was being secured by the British government through its contractors.[73] These could have been seriously disrupted by war or any other event which might have caused the withdrawal of the British vessels from service. Furthermore, it was evident that the economies of scale which the British lines were likely to achieve as a result of promotional subsidies would increase their competitive advantage in the competitive foreign trades unless American lines were developed simultaneously. The equilibrium was, indeed, unstable, and hence

[71] S.C.C.P.S., 1853, p. 2.

[72] 5 U.S. Stat. 748; Saugstad Report, p. 50.

[73] Saugstad Report, p. 49.

the major part of the traffic was likely to go to the first concern to reach large size. This infant-industry argument was the most important of the purely economic reasons advanced. Of much greater political value, however, was the argument that it was essential to offset the military and naval advantages which Great Britain was able to secure from her mail fleet. These arguments, rather than any desire to protect the packet-ship owners and other vested interests, who, in fact, received scant consideration, led to the decision to subsidize the American ocean steam services.

Because of the backwardness of the industries of building and operating ocean steamships in the United States, the government had no adequate standards on which to base contracts, and hence made serious errors. Contractors had to be coaxed to appear, and every paternal power the government possessed had to be used to keep them in business. All of the problems and abuses involved in the promotion and regulation of the steamship business which have since been encountered appeared at once.

The costs of building and operating American ocean steamships were so high, indeed, that, although American sailing ships made their way successfully, no steam line was likely to be established without considerable assistance. Only one steam-driven transatlantic liner was built in the United States before 1847, and this vessel, the 751-ton auxiliary screw ship *Massachusetts*, which was built in 1845 and owned by R. B. Forbes of Boston, failed to succeed financially, and was sold to the government during the Mexican War.[74]

As had generally been the case in England, it was impossible to secure satisfactory competition for contracts, although four proposals — including one by Junius Smith, the operator of the pioneer vessel *Sirius* — were made, and awards had to be made by negotiation. Two additional proposals were later made by R. B. Forbes, who asked for $500,000 for a line to Havre, and E. K. Collins, who wanted $385,000 for a five-ship line to Liverpool. The first of these contracts was made on June 19, 1846, with Edward Mills, who shortly afterward formed the Ocean Steam Navigation Company. It embodied Mills's proposal to transport the mails by means of four steamships sailing semimonthly from New York alternately to Bremen and Havre, call-

[74] Lindsay, *History of Merchant Shipping*, IV, 190–194; D. B. Tyler, *Steam Conquers the Atlantic* (1939), pp. 129–132.

ing at Southampton each way, for a total of $350,000 annually, of which $200,000 was to be allotted to two ships for the Bremen service and $150,000 to those on the Havre run.[75] Mills subsequently was unable to raise sufficient capital until the Senate of Bremen, with the aid of some of the other German states who were anxious to secure direct postal service and steamship accommodation for immigrants, contributed $286,000 through American business firms to the capital stock of $534,000 of the Company, which then came largely under German control.[76] This was done to secure the German line. The Bremen service was therefore begun with the sailing of the paddle steamship *Washington*, 1640 gross tons, from New York on June 2, 1847, and of the *Hermann*, 1734 gross tons on March 21, 1848. The subsidy that was paid under a new contract signed in 1847 was at the rate of $200,000 for twelve round-trip voyages. These ships, which were built by Westervelt & McKay at New York, greatly exceeded in cost the original estimates, although they performed poorly, being much slower than the Cunard and later Collins liners. Service was also begun in 1849 to Havre with a line of ships then controlled by the packet-ship operator Mortimer Livingston. This fleet consisted of the steamships *Arago* and *Fulton*, which were supplanted in 1850 by the *Franklin* and *Humboldt*, of 2184 tons each. The contracts of 1847 were renewed for another five years in 1852 at the same rates, namely $200,000 for the Bremen line and $150,000 for the Havre line. These lines were only a qualified success, for the ships were more costly to build, repair, and operate than was anticipated, were too slow to secure much of the European mail business, and were soon obsolete.[77] Although some dividends were declared, the relatively large subsidy paid was, under the circumstances, insufficient to induce development and expansion, and hence both lines languished.

[75] Saugstad Report, p. 50.

[76] Saugstad Report, pp. 49–51; Erich Murken, *Die grossen transatlantischen Linienreederei-Verbände, Pools, und Interressengemeinschaften* (1922), p. 147; Paul Neubauer, *Der Norddeutscher Lloyd, 50 Jahr der Entwicklung, 1857–1907*, 2 vols. (1907), I, 9–11; Tyler, p. 148.

[77] C. H. Haswell, the Chief Engineer of the Navy, stated that the *Washington* and *Hermann* were failures in many important respects; see Graham Report, p. 139.

7

The Havre and Bremen lines partly supplemented and partly competed with the Cunard Line. The Collins Line which operated on the heavily traveled route [78] between New York and Liverpool, was, however, a direct challenge to the latter. This line was founded by E. K. Collins, the owner of the Dramatic Line of sailing packets and an experienced operator of passenger ships,[79] who as early as 1841 had been lobbying for steamship subsidies.[80] Proposals were submitted by him to the Postmaster-General for a Liverpool line in 1846, but no action resulted until the Act of Congress of March 3, 1847 [81] authorized the Secretary of the Navy to accept Collins' offer. This provided for the construction of five steamships of 2000 gross tons or more and of 1000 horsepower or more, suitably built for service as first-class warships, and for the operation of these ships on twenty round-trip voyages to Liverpool annually for the sum of $385,000 per year for ten years.[82] Congress was thus determined to free the United States from dependence on and possible exploitation by the British contractor.[83]

In contrast with the experience of the British government in connection with the Cunard Line, the United States government soon found that the contractor had made serious errors in his estimates, which the government had not properly examined, with the result that the New York and Liverpool Mail Steamship Company, as the line was called, was unable to perform its contract in full. The Company had seriously underestimated the costs of construction of its vessels, with the result that it was forced to apply to Congress for the loan of funds to complete them. These advances which were authorized by the Act of Congress of August

[78] Both because of the steamship services terminating there and because of its advantageous location, Liverpool became the primary port of departure in the westbound transatlantic passenger trade. For instance, in 1859, of the 85,602 passengers arriving at New York, 41,841 were from Liverpool, 13,164 from Bremen, 9,043 from Havre, and 8,552 from Hamburg. See "Castle Garden Report, 1859," *R.N.Y.C.C.*, 1859–60, p. 279.

[79] Albion, "E. K. Collins," in *Dictionary of American Biography*, IV, 305–306.

[80] Albion, *The Rise of New York Port*, p. 323.

[81] 9 U.S. Stat. 187.

[82] Saugstad Report, p. 52.

[83] For a statement of the attitude of many members of Congress see the *Report of the Committee on Post Offices and Roads on Mail Steamships* (1852), Senate Rep. no. 267, 32 Cong., 1 Sess., pp. 1–6. (Hereafter cited as the Rusk Report.)

3, 1848, totaled a year's mail pay, or $385,000, and were repayable in ten annual installments.[84] By the Act of March 3, 1851, interest on these loans up to that date was waived.[85] Furthermore, the vessels, which required machinery of unprecedented power, were delayed in construction owing to the difficulty of securing such machinery from the New York engine builders,[86] and it was necessary to delay the initiation of the service by Act of Congress from April 1, 1849 to June 1, 1850.[87] No allowance appears to have been made for the inevitable fall in freight and passage rates and for the division of the business which followed the establishment of the line. Neither was the possibility of increased British support of the Cunard Line evaluated. Hence the amount of aid needed was seriously underestimated, and additional subsidies became necessary if the line was to survive. The Company in general appears to have acted on the principle, which later was all too commonly adopted, that sufficient aid would be forthcoming no matter what the expenses were.

Four large bark-rigged [88] paddle ships were built for this service by the Collins Line, but it proved to be impossible for the contractor to provide the fifth one in the beginning.[89] As a result of the over-optimism of Collins and his builders, these were designed to be the largest, fastest, and most luxurious liners ever laid down. The wooden hulls, all of which were in excess of 3000 gross tons and measured some 300 feet in length, were the largest yet built,[90] and were to be exceeded in size prior to the Civil War only by Donald McKay's shipentine *Great Republic* and the later Collins liner *Adriatic*. The models, which were worked out by Collins and his naval architect, the celebrated clipper-ship designer George Steers, provided for vessels of flush-deck packet-ship appearance, sharp ends, and plumb stem. Because of their size, special care was taken to provide strong hulls by means of solidly laid heavy live oak floors, heavy white oak upper futtocks,

[84] Graham Report, p. 3; Saugstad Report, p. 52; 9 U.S. Stat. 266.
[85] 9 U.S. Stat. 621.
[86] Graham Report, p. 12.
[87] Graham Report, p. 2.
[88] These vessels could sail nine knots under sail alone.
[89] Graham Report, p. 2.
[90] Graham Report, p. 129. The gross tonnages shown on the registers were as follows: *Arctic*, 2856 tons; *Atlantic*, 2845 tons; *Pacific*, 2707 tons; *Baltic*, 2723 tons. Because of some six feet of depth not included in the measurement these figures considerably underestimate the size of the vessels.

a huge keelson, four complete decks, and a large amount of iron strapping. It may be doubted, however, if the construction of such large steamships of wood was economical, for the expense of the timber and of the construction work was necessarily exorbitant. The hulls were bound to become badly strained and to be short-lived, and the carrying capacity was limited by the great weight of the materials. The large British contractors, notably the Peninsular and Oriental Company, were, in fact, endeavoring to have the British Admiralty accept iron hulls instead of wooden ones as early as 1850, it being argued that in ships of more than 2500 gross tons and 800 horsepower iron construction was much stronger, lighter, more durable, and cheaper, and that the use of timber unnecessarily increased the cost of service.[91] It was, indeed, fully apparent that in these Collins ships the economical limit in size for wooden steamship hulls had been reached.

The Collins liners were built by two of the leading New York builders of packet ships, namely William H. Brown, who contracted for the *Arctic* and *Atlantic*, and Brown & Bell, who contracted for the *Baltic and Pacific*. The engines, which rated in excess of 1000 horsepower and were of the side-lever type similar to those used on the Hudson River, were built by two of the leading American marine engineering firms, the Allaire Works and the Novelty Works.[92] They were designed by two engineers of the United States Navy, Messrs. Sewall and Faron, who had made a special study of British engineering for the purpose. Since the machinery was of unprecedented size and power, some difficulty was experienced in the shops in successfully bringing it to completion. Every effort was made to secure strong and powerful machinery which would enable the ships to outsail the Cunard ships. There can be no doubt that from the technical standpoint every effort was made to produce the largest, strongest, and fastest wooden ocean-going paddle steamships ever built.

It was significant, however, that the cost of these ships was greatly in excess of that of comparable British wooden liners. This was due to the insistence of Collins on building vessels to specifications in excess of those established in his contract, to the

[91] *Correspondence between the* [British] *Lords of the Admiralty and Steamship Companies Relative to the Exclusion of Iron Steamships from the Packet Service* (1850), Parliamentary Papers, 1851, vol. LI, no. 86.

[92] C. B. Stuart, *The Naval and Mail Steamers of the United States* (1853), p. 123.

desire of the government to secure first-class war steamships capable of carrying the heaviest guns, to the large amount of high-priced labor required in building the hulls and engines, and to the decision to construct the ships in the high-cost New York shipyards, which were then filled to capacity with clippers and packets. Hence, although Collins had originally planned to build moderate-sized vessels of about 2000 gross tons each, which it was estimated would have cost about $400,000 apiece,[93] his ships finally cost the colossal sum of $2,944,143, or about $735,000 each.[94] This was greatly in excess of the figures for the smaller *Washington* and *Hermann*, which cost $252,000 and $360,000 respectively,[95] and of the $600,000 figure for the United States war steamships *Missouri* and *Mississippi*.[96] In comparison, the comparable Cunard Liners *Asia* and *Africa* cost but about $575,000 each,[97] and the huge Peninsular and Oriental liner *Himalaya*, 3540 gross tons, about $650,000.[98] In general, wooden liners may be estimated to have cost from 25 to 33 per cent less in Great Britain than in the United States. Thus unlike the industry of building sailing ships that of constructing steamships was operating at a competitive disadvantage from the beginning. The subsidy accordingly had to cover the unfavorable differentials of both the shipping and shipbuilding industries.

The Collins Line began operations with the *Atlantic* and *Pacific* on April 27, 1850, and the remaining two vessels were added before the end of the year.[99] There followed a bitter commercial struggle between the Cunard and Collins lines, in which the Inman, Great Western, Bremen, and Havre lines were also involved. The British government, which viewed the establishment of the Collins Line as a direct challenge[100] rather than as a supplementary service, was unwilling to allow its contractor, who possessed many advantages, to suffer. Two new ships, the *Asia* and *Africa*, which were destined for the direct New York–Liverpool run and had been laid down as a result of the increase in the subsidy granted in 1848, were added to the line in 1850. Keen competition soon arose between the rival lines. Freight and pas-

[93] Statement of E. K. Collins, Graham Report, p. 129.
[94] Stuart, p. 116.
[95] Statement of C. H. Haswell, Chief Engineer, U.S.N., Graham Report, p. 139.
[96] Statement of C. H. Haswell, Chief Engineer, U.S.N., Graham Report, p. 139.
[97] Marvin, p. 249.
[98] S.C.C.P.S., 1853, p. 65.
[99] Graham Report, p. 2.
[100] S.C.C.P.S., 1853, p. 20.

senger rates were reduced by almost one half,[101] and the business was divided among the various vessels. Probably only the exceptionally strong demand for tonnage prevailing at this time prevented even more severe declines in rates. This, of course, was the inevitable result of unregulated competition between the contractors of the rival nations, and should have been foreseen.

The Collins Line consequently began to operate at a serious financial loss. The average gross income on the first forty-one voyages was $48,287, of which $19,250, or 40 per cent consisted of subsidy money, and the average expense was $65,216, thus leaving an average deficit of $16,929.[102] This occurred although the Collins ships proved to be slightly faster than the Cunard vessels, and were initially extremely popular with the passengers because of their size, appointments, and service. They carried during 1852, for instance, 50 per cent more passengers westbound, and 30 per cent more eastbound than the Cunard Line.[103] The latter, however, claimed and secured in contracts of 1850 and 1852 an increase in its subsidy from £145,000 to £173,340 ($843,600) per annum, which sum was equivalent to a subsidy of about $19,000 for each of the forty-four voyages a year. Collins, who was an experienced lobbyist, consequently was able in return to induce Congress by the Act of August 30, 1852, to increase his subsidy substantially to $33,000 per voyage for twenty-six voyages per year, or to a total of $858,000 per year.[104] To this action the British government made no direct reply, being apparently satisfied with the ability of its contractor and shipbuilders to compete successfully. The Select Committee of 1853 in fact considered that the initial objectives of British policy had been achieved, and recommended a reduction in the subsidies wherever possible.[105] The estimated excess of the British subsidy over the heavy postage receipts attributable to the service was then about £61,642 per year.

In the ensuing competition the Cunard Line, which had the advantages of established connections and economies associated with a larger service, and was better managed in every way,

[101] Meeker, 9; Saugstad Report, pp. 52–53; Rusk Report, p. 6.
[102] Rusk Report, p. 7.
[103] Saugstad Report, p. 53; Stuart, p. 129.
[104] 10 U.S. Stat. 61; Saugstad Report, p. 52.
[105] S.C.C.P.S., 1853, p. 2.

forged ahead. Its fleet increased with considerable rapidity, the *Arabia*, 2400 tons, being added in 1852, and the iron paddle steamship *Persia*, 3766 gross tons, with a speed of thirteen knots, in 1855. Meanwhile the Collins Line lost the *Arctic* by collision in 1854, with fearful loss of life, and the *Pacific*, which disappeared with all hands in 1856. The line added the huge wooden paddler *Adriatic*, 4144 gross tons, in 1856, which was built at a cost of over $1,000,000, but in comparison with the *Persia* she was heavy, costly, inefficient, and obsolete.[106] She made but one voyage in the Collins Line, and soon afterward was laid up.[107] Dissatisfaction with the service led President Pierce in 1855 to veto the bill providing for the continuation of the extra subsidy, with the consequence that in the following year the pay was reduced to the original $19,250 per round voyage.[108] This action, together with the general economic depression in the shipping industry, produced still more difficulty for the firm, which had never paid a dividend. Finally the government, dissatisfied with the situation, in 1858 cancelled all mail contracts,[109] and the extravagantly-managed Collins Line thereupon collapsed.

8

Subsidized American mail steamships were operated during this period on one other important American sea route, namely that from New York to California and Oregon by way of the Isthmus of Panama. This line, like the British services to the Far East, was essentially non-competitive, although the fact that it was necessary to break the line into two parts, each terminating at a foreign port, made foreign competition legally possible. Such competition did not develop, however, although the Cunard Line in 1853 was seriously considering the establishment of a connecting service from New York to Panama, thus linking its Atlantic service with those of the Pacific Steam Navigation Company and a projected line to Australia.[110] For this line the Cunard Company asked for a subsidy of £1,000 per round voyage,[111] but nothing ever came of the proposal. The American subsidy, like

[106] Cramp, "The Evolution of Screw Propulsion in the United States," pt. 1, pp. 154–155.

[107] Jackson, p. 110.

[108] 11 U.S. Stat. 102 (Aug. 18, 1856); Saugstad Report, p. 53.

[109] 11 U.S. Stat. 364 (June 14, 1858).

[110] S.C.C.P.S., 1853, p. 22.

[111] S.C.C.P.S., 1853, p. 22.

the British, was designed mainly to improve the speed of communication between the East Coast and Oregon. A primary motivating force in this connection was the boundary dispute between Great Britain and the United States with respect to Oregon, which made the government desirous of having facilities available for the rapid movement of troops. It was felt that facilities for regular, rapid service were not likely to develop in the absence of direct state action. Accordingly, under the Act of March 3, 1847, contract subsidies designed to secure the desired service were established.[112]

As in the case of the Collins Line, it was impossible to award the contract by competitive bidding. The result was that on April 20, 1847, the Navy Department awarded a contract for the Atlantic portion of the service to A. G. Sloo, who on September 3 assigned it to the principal capitalists involved, George Law, Marshall Roberts, and Bowes McIlvaine of New York. They thereupon established the United States Mail Steamship Company. The contractors were to provide five steamships of 1500 gross tons and 1000 horsepower, which were to be built to the same dimensions, scantlings, and design as the United States war steamer *Missouri*.[113] The paddle-wheel propelling machinery was to be direct acting, as in the war steamer, and was to be placed well below the water-line as a protection against shot. The government was thus requiring the contractors to build for commercial service vessels which in nearly all respects resembled war steamers — an uneconomical policy. These vessels were to be employed on a coastwise service between New York and New Orleans, touching at Charleston, Savannah, and Havana, sailings being made twice a month.[114] From Havana one vessel was to carry the New York and New Orleans mails to Chagres. The subsidy for this service was to be $290,000 per year. This contract was also designed, it will be observed, to improve the coastwise service then conducted in the New York packet ships.

The contract for the Pacific service was placed on November 16, 1847, and was assigned to the principal capitalists, who were headed by William H. Aspinwall of New York, on November 19, the line subsequently becoming known as the Pacific Mail Line, or "Aspinwall" Line. Thus by intent or necessity the Pacific

[112] 9 U.S. Stat. 187; Graham Report, p. 1.
[113] Graham Report, pp. 3–4.
[114] Graham Report, pp. 3–4.

service was placed in different hands from those handling the Atlantic service, and hence some danger of financial conflict and inefficiency existed. The most satisfactory policy, which was generally followed by the British, and later by the French and Germans, was to place entire control of a route and its extensions in the hands of one contractor. The Pacific Mail Line agreed to provide three steamships, two of which were to be of not less than 1000 gross tons, and the other of not less than 600 gross tons, all of which, like those of the United States Mail Line, were to be first-class war steamers built under the supervision of the Navy Department.[115] With these vessels a monthly service from Panama to Astoria in Oregon was to be maintained. The subsidy, which was to run for ten years, was to be $199,000 per year.[116] Connection between the two services was provided at first by caravan, but this inefficient and dangerous mode of transportation was supplanted in 1855 by the Panama Railroad, which was incorporated on April 7, 1849, and was controlled by the Aspinwall interests.[117] The capital was supplied chiefly by the Aspinwall and Law interests and by the Royal Mail Company.

Although in general both services were better performed than those on the North Atlantic routes, the same difficulties arose. The government was forced to accept the ships and service offered by the contractors for lack of any alternative enterprise which would carry out the desired service. Until the California gold rush created a heavy traffic, there was considerable doubt as to the ability of the contractors to carry out their assignments with the established rate of pay. The United States Mail Line at first built only two large vessels, the *Georgia* and *Ohio*, of 2727 and 2434 gross tons respectively, instead of the five ships of 1500 gross tons as originally contemplated. They did, however, purchase the new 1000-ton steamship *Falcon*, which began the service with a sailing from New York to Chagres by way of New Orleans on December 5, 1848.[118] Both the *Georgia* and the *Ohio* departed in dimensions and engineering details from those specified, although they were excellent commercial paddle steamships. The first of these large vessels, the *Ohio*, did not sail from New York for New Orleans until September 20, 1849, although the original contract had specified that two new vessels were to be ready by

[115] Graham Report, p. 5.
[116] Graham Report, p. 5.
[117] Saugstad Report, p. 56.
[118] Graham Report, p. 112.

October 1, 1848. The Attorney-General so construed the law, however, that the company was paid its full subsidy instead of a pro rata one.[119] In addition, advances were made by the government to complete the ships. But with the development of the gold rush new vessels were completed as rapidly as possible, the 2101 gross ton *Illinois* being added in September, 1851,[120] and a number of other vessels subsequently. By 1852, the company had nine steamships in service, although only two met contract requirements.[121] The voyages, which were now predominantly from New York to Chagres via Havana, showed a little profit. Figures for the six-month period from April to September, 1852, showed for the fleet commercial revenues of $836,879, mail pay then amounting to $145,000, and expenses, including insurance, of $746,326, leaving a gross profit of $235,553.[122] But the deduction of depreciation charges of $140,300, computed at 10 per cent per year on the $2,806,000 cost of the fleet, leaves only $95,253 as an overall return for the half year on the capital invested. Earnings were thus at this time ranging between 6 and 7 per cent per annum on the original cost of the fleet, which earnings were not excessive for a shipping firm in boom times.

The Pacific Mail Line enjoyed the distinction of being the only contractor to provide a full quota of vessels and to begin the service practically on time. The Company's steamships *California*, *Panama*, and *Oregon*, of about 1050 gross tons each, passed the naval inspection on October 5, November 28, and December 9, 1848, respectively, and shortly afterward sailed for the Pacific. The *California* arrived at Panama 116 days from New York on January 30, 1849, and at San Francisco, then the principal terminal, on February 28, with the first New York mail to be carried by steamship.[123] Two additional vessels, the *Columbia*, 718 gross tons, and the *Tennessee*, 1295 gross tons, were also built by the Company and accepted by the Navy. Beginning in 1851 the service was extended to Astoria. In 1851 the contractor also applied to Congress for an additional subsidy, which was authorized in

[119] Graham Report, p. 4.
[120] Graham Report, p. 4.
[121] Saugstad Report, p. 54.
[122] Rusk Report, p. 34; Saugstad Report, p. 55.
[123] H. C. Needham and V. M. Berthtold, "Ahead of the Mails, a Brief Story of the Transportation of the U. S. Mail by Sea, 1848–1860," *Collectors Club Philatelist*, VII (1928), 100.

the Naval Appropriation Act of March 3, 1851, and in return the line was to provide a semi-monthly service matching that of the Atlantic line.[124] Accordingly a contract for such service carrying an increased subsidy of $149,250, or a total of $348,250 per year was signed. The Company consequently ordered the paddle steamship *Golden Gate*, 2067 gross tons, which passed inspection on July 31, 1851, thus bringing the number of ships in service up to six [125] as specified in the contract. On this basis the line operated regularly and profitably.

As a result of these subsidies the United States secured a regular semi-monthly high-speed service for mails, passengers, and military forces to its new possessions. The time of transit was reduced from the 100 to 150 days required by sailing ships going by way of Cape Horn, which route was the only practicable one for them because of the great calms in the Bay of Panama, to between 21 and 30 days. Passengers practically deserted the clippers for the shorter and safer steamship service. Connections were made at Panama with the services of the British Royal Mail and Pacific Companies, thus providing an interlocking system. Furthermore, the ships built, which cost a total of $5,124,777,[126] were of a type which would have been useful in war for cruising against enemy merchant ships or for transport service. Whatever may have been the weaknesses of the policy, it is evident that in the absence of substantial aid regular service by such large vessels could not have been established. It is also evident that these lines, which were free from serious foreign competition and enjoyed a notable monopolistic position among domestic owners, were able to secure such economies and patronage that on the abandonment of the subsidy in 1859 they were able to continue operations. For these reasons the subsidies to the Pacific lines may be said to have been the most successful of those given at this time.

9

The economic history of this period clearly indicates that American ship subsidy policy was based on erroneous principles to a considerable extent. Both the objectives of the policy and the techniques to be employed were poorly defined by the govern-

[124] 9 U.S. Stat. 623; Saugstad Report, p. 55.

[125] Graham Report, p. 7.

[126] Saugstad Report, p. 55.

ment. Furthermore, the subsidy policy was poorly administered in comparison with that of Great Britain. In general the government had no definite theory of the public interest in this respect, and consequently the policy drifted.

The lack of a definite objective caused a serious waste of resources. The purposes of British policy were clearly stated by the Select Committee on Contract Packets in 1853. They were to provide more frequent, rapid, and punctual communications on the principal British overseas lines of communication than it would have been possible to secure under a policy of laissez-faire; to promote the construction of modern steamships and the growth of large steamship lines by means of developmental aid, and to provide a number of ships which would be useful in war.[127] Subsidized services were to be provided only on routes on which the benefits to commerce would be substantial or imperial defense and administration would be increased in effectiveness.[128] In general the state was to control and regulate the entire contract ocean communications system.[129] Challenges by other nations to the development of the system were to be met, if necessary, by increased subsidies or other action.[130] Every effort was to be made, however, to reduce the amount of the subsidies as the lines matured, and to prevent the payments from becoming excessive relative to benefits. The primary objective was not, therefore, to rival other nations, or necessarily to increase the total tonnage of British shipping.

The American subsidies to the Bremen, Havre, and Pacific services were undertaken with much the same objectives in mind. The Collins subsidy, however, was actuated by a desire to rival the British line, and payments were throughout the period considerably more than were necessary to countervail those of Britain. Probably they were also greater than those which would have been required had there been proper regulation of the contractor. Furthermore, little effort was made to administer the system economically or to reduce payments as the contractors achieved economies and reputation. The American government was, in fact, working with shipbuilding and shipping firms which were much less likely to secure economies of scale than the corresponding industries in Great Britain. By placing strong em-

[127] S.C.C.P.S., 1853, p. 2.
[128] S.C.C.P.S., 1853, p. 3.
[129] S.C.C.P.S., 1853, p. 3.
[130] S.C.C.P.S., 1853, p. 3.

phasis on the competitive Liverpool and Southampton services the government created the impression that it was on these routes that American interests were most threatened, whereas actually it was the network of services which centered in Great Britain and made her a hub of world communication which was most likely to injure American trade. The American government made no effort, however, to develop a comparable network reaching such non-competitive regions as the West Indies, South America, the Mediterranean, or the Baltic. The effort to rival the efficient, well-established Cunard Line, which effort was unlikely to succeed in overthrowing it and would have been disadvantageous to the country if it had succeeded, therefore led to a considerable waste of resources. The failure of the government to devise sound economic objectives of its subsidy policy was, therefore, a great weakness.

With the economic objectives were entwined naval ones. In comparison with foreign navies that of the United States had remained extremely weak since the War of 1812. The country possessed no battle fleet capable of meeting even a portion of that of a major foreign nation. Indeed, the United States Navy possessed in 1852 but sixteen war steamers mounting 73 guns, in comparison with the 320 such vessels mounting 1520 guns then in the British navy.[131] The government had been relying mainly on the commerce-raiding abilities of a few fast frigates and converted sailing merchantmen. The introduction of steam in European navies made it seem probable, however, that such vessels could neither flee nor fight successfully, and hence some action was necessary. The result was that the Navy was given a small number of wooden steam frigates, the first of which was Robert Stockton's screw frigate *Princeton*, completed in 1842.[132] These were followed by the paddle frigates *Mississippi* and *Missouri*, which mounted two ten-inch and eight six-inch explosive-shell guns.[133] It was believed that the subsidized mail vessels could be so built as to be convertible into warships of similar class, and hence the government required heavy construction, suitable models and arrangements, and the employment of naval officers on board. Provisions governing the use of such vessels by the Navy in war were also inserted in each contract. These requirements undoubtedly somewhat increased the costs of construction

[131] Rusk Report, p. 18. [132] Haswell, pt. 1, p. 109. [133] Sprout, p. 114.

and operation, although not as much proportionately as became general in the age of iron ships, and hence decreased the economic effectiveness of the vessels.

This belief, which widely prevailed in Congress from 1841 onward, that subsidized mail ships would be powerful warships, was an important factor inducing that body to establish the subsidy policy.[134] British opinion was cited in support of this view. The theory was utterly unsound, however, for the converted steamers were neither powerful enough to fight armored steam warships nor fast enough to avoid them, and the United States possessed no navy capable of keeping such vessels out of reach. Furthermore, but little opportunity offered to exercise the mail ships in gunnery and manoeuvers. Hence in any major war, although the converted mail ships might for a time have been successful commerce destroyers, nevertheless the eventual destruction or blockade of such ships was inevitable. The naval value of some two dozen such vessels, when operating without secure bases and the protection of a powerful war fleet, was extremely low. In addition, the cost of their operation in peace time was certain to be high. In war, if the Navy controlled the sea, such craft could be more advantageously employed on their normal services, and in peace unnecessary expenditure reduced the amount of service which could be rendered for a given sum of money. Official British theory followed this latter line as early as 1853, it being argued by the investigating committee of that year that, although inexpensive naval features should be incorporated in mail steamers, no major deviations from the most commercially desirable form of ship should be made.[135] Technological changes had, in fact, greatly reduced the fighting power of merchant ships, although simultaneously it had increased the value of such ships as transports, supply ships, and carriers of industrial raw materials and foods.

The techniques of the American subsidy policy was likewise unsound. One of the primary weaknesses was the requirement that the vessels be built in the United States at cost levels considerably above those prevailing in Great Britain. Thus not only were expenses increased, but also, it proved to be impossible to secure iron hulls and the most efficient machinery. The experience of the United States, as well as that of other nations, shows

[134] Sprout, pp. 133–134.

[135] S.C.C.P.S., 1853, p. 5.

clearly that in building up a shipping industry under unfavorable conditions it is essential to secure the best possible vessels at the lowest possible prices. In contrast, the American subsidized fleet was relatively costly, and in addition developed many weaknesses in machinery and hulls. There was also inadequate control over the operations of the contractors. While serious abuses such as appeared in railroad construction did not arise, no careful supervision was exercised, although the contractors were essentially agents carrying out important public policies and spending public money. Hence the majority of the contractors produced ill-conceived plans, unduly increased the size of their ships and their expenditures, and were unable to complete their agreements without the aid of increased subsidies and loans. The lobbying practices which have been typical of American steamship operators consequently became notorious, and soon brought the industry into disrepute. The failure of the government to exact proper penalties for non-performance, as was done by the British government,[136] was also a serious weakness. The latter, by means of close personal contact, short-term contracts, and steady support, was indeed able to supervise its lines with considerable success, and frequently forced improvements in service to be undertaken. For instance, in 1858 the Admiralty forced the Royal Mail Company to undertake the construction of three iron ships of increased speed in order to secure a renewal of an existing contract.[137] The experience of the United States and Great Britain at this time showed clearly that private firms could be relied upon to perform subsidy contracts in a satisfactory manner only if the services were properly planned and financed, and were supervised by a public authority possessing adequate standards and power.

Further weaknesses were the failure to define the relationship between the government and the contractors, and between the contractors and the shipping interests at large. It was scarcely recognized that in establishing subsidized steamship lines essentially monopolistic organizations were created which were affected

[136] S.C.C.P.S., 1853, p. 19. Severe penalties were applied for defects in design, late sailing, deviations, and late arrivals.

[137] *Returns and Correspondence Relating to East Indian, South American, and Australian Contract Mail Services* (1858), Parliamentary Papers, 1857–58, vol. XLI, no. 144, pp. 5–11.

with a public interest. The Treasury, Post Office, Navy, and public at large were vitally concerned with the proper performance of the services. On the other hand, the government could not abandon its support or favor another contractor on the same route without causing serious losses to investors, an interruption of service, and a loss of confidence in government policy which would restrict investment and raise the cost of capital in the future. Hence steady, reasonable support of the services which were deemed essential in the public interest, combined with long-term contracts and strong supervision of operations, was the only solution. These principles were, in fact, being informally approximated by the British government with great success. The American government, however, was unwilling either to supervise its contractors or to assume full responsibility for the support of the services, with the result that the system was a failure. The public reacted against the expenditure, and the contracts were canceled, with a considerable loss of confidence in such enterprise among entrepreneurs.

Another difficulty was the jealousy of the great mass of unsupported sailing-ship owners and shipbuilders, which contributed to the political downfall of the system.[138] There was, in fact, no reason to suppose that the contract system was incompatible with the operation of a large volume of free commercial tonnage, although, of course, directly competing services were injured. Had it been understood that the contract operators were performing special service for additional compensation, and that their operations would be carefully supervised, much of the jealousy would have been dissipated. A group of subsidized monopolies were in fact certain to arise. Only if large general navigation bounties open to all ships meeting the qualifications specified had been given could competition in the subsidized services have been preserved. Such a system would have expanded the merchant marine generally, but at the cost of large sums and the sacrifice of some of the objectives of government policy. No emphasis was, in fact, placed on a general expansion at this time.

The first American subsidy experiment thus closed in 1859 unsuccessfully. The total outlay had been about $14,000,000, of which the Collins Line had received about $4,500,000, the United States Mail Line $2,900,000, the Pacific Mail Line $3,750,000,

[138] Saugstad Report, p. 53.

the Bremen line $2,000,000, and the Havre line, $750,000.[139] Offsetting postal revenues can scarcely have exceeded 50 per cent of the cost.[140] In return the United States received a notable improvement in the service to California and Oregon, and some improvement in that to Europe. Some two dozen fast wooden mail ships were built, which, however, were soon obsolete and of small naval value, especially after armored battleships appeared in the early 'sixties. These, however, were practically the only registered steam vessels under the American flag. Only one service, that of the Pacific Mail Company, was able to mature and remain in operation. The others soon collapsed as a result of poor planning and management by both the government and the contractors, with the result that subsequently it was difficult to secure capital for the industry. On the whole, therefore, the results were hardly comparable to the expenditure.

[139] Meeker, p. 156.
[140] Saugstad Report, pp. 53–55. Up to 1852 postal revenues equalled 28 per cent of the Collins Line subsidy and 58 per cent of those given to the Pacific services.

PART III

METAL SHIPS AND LARGE-SCALE ENTERPRISE: 1863–1914

CHAPTER XII

THE LAST AGE OF THE BUILDING OF WOODEN SHIPS IN THE UNITED STATES, 1863–1914

I

Between the civil war and 1914 maritime progress followed two paths. First, steam navigation developed on the short and intermediate sea routes along which cheap coal supplies were available. Second, sail navigation continued to dominate in the long-voyage trades, which were as yet largely closed to steamships. In the development of the steamship network American shipbuilders and owners played only a small part, except within the protected waters of the navigation monopoly, because of the relatively high costs of iron, labor, and capital. The owners of such vessels, who were doubly burdened by both high ship prices and unfavorable operating differentials, invested in foreign-flag ships or ventured into the foreign carrying trade only when subsidized. In the sailing-ship trades, however, it was still possible for American firms to operate wooden vessels, which could be bought by American owners at prices close to the world levels for sailing tonnage. Consequently, until the turn of the century the American fleet in foreign trade, unlike that of other nations, consisted primarily of sailing vessels.

An examination of the economies of ship operation shows that during this period there were many employments in which sailing ships could be advantageously used. Because of the great length of many trade routes, especially those passing around Cape Horn and the Cape of Good Hope, and of the expense of securing suitable coal supplies at distant ports, the field of profitable operation for steam freighters was confined mainly to the North Atlantic Ocean for some three decades after the Civil War. Furthermore, in the long-voyage carrying trades the low grade of the cargoes, which consisted chiefly of grain, coal, hides, jute, coffee, wool, and case oil, the uncertainty regarding freights, the long periods in port, keen competition, and the absence of premiums for speed made the sailing ship, which had low overhead costs and could pursue

her voyage to any port independently of coaling facilities, a most economical carrier. When operating in these carrying trades, steamships, which could carry coal economically for not more than from ten to eighteen days' steaming, were forced to secure their fuel supplies at numerous stations along these routes. Good local coal deposits were not available, however, at important ports of call, such as the Azores, Cape Verdes, St. Helena, Ascension, Mauritius, and Hawaii, nor in South America, Africa, or the East Indies. Hence supplies had to be sent out to these ports at considerable expense by sailing vessels. Even the auxiliary sailing ships, which were occasionally built in England in the 'sixties, proved to be inferior to ordinary sailing vessels, for they were slow and inefficient under both sail and steam, their rates of coal consumption and their overhead expenses were high, and their cargo capacities were low.[1] Consequently, sailing ships were widely employed by the shipowners of all nations in the ordinary carrying trades from California, South America, India, the East Indies, China, and Australia to the North Atlantic ports of Europe and America.

Even on some of these routes, however, steam navigation made serious inroads. The opening of the Suez Canal in 1869, which was one of the most important events in economic history, enabled the new, more efficient, compound-engined steamships then being built to compete for the traffic from the Middle East to Europe and for part of that to America as well.[2] This great public investment shortened the distance between London and Bombay by about 5800 sea miles, or by about 50 per cent, as sailing ships were then navigated, and that from London to Hong Kong by about 3500 miles, or 33 per cent.[3] Nevertheless, since the long, narrow Red Sea was swept with head winds and frequented by calms, big square-rigged vessels could not be safely and economically used on this route. In fact, had the canal been built eight or ten years earlier scarcely any vessels would have used it, for sailing ships could not have been navigated to advantage on this route, and the coal consumption of steamships would have been too great to allow of their general use.[4] The introduction in

[1] A. E. Seaton, Discussion, *Trans. I.N.A.*, XLI (1899), 45.
[2] Clapham, *Economic History of Modern Britain*, II, 72.
[3] J. d'A. Samuda, "On the Influence of the Suez Canal on Ocean Navigation," *Trans. I.N.A.*, XI (1870), 1–2.
[4] Samuda, pp. 1–2.

the early 'seventies, however, of steamers of an improved design, which vessels were of about 2000 gross tons, had a speed of nine knots, and burned but fourteen tons of coal per day, in place of the older vessels, which were of about 1400 gross tons, steamed but seven knots, and required forty tons of coal per day, made steam navigation economically possible on this route.

As a result, on the opening of the canal the price of sailing-ship shares fell heavily in London,[5] and to some extent in the United States as well. The last of the British tea clippers, the *Black Adder*, *Halloween*, and *Lothair*, left the shipways in 1870,[6] and in 1872 the last tea race was sailed.[7] Many British owners of sailing vessels became pessimistic because they foresaw little business except that of carrying coals for steamships.[8] In the United States, however, the effect was less pronounced, but it sufficed to check the construction of sailing ships for the China and East India trades. Among the last of the American India-men were the live-oak ship *Governor Goodwin*, 1459 tons, the *Panay*, 1190 tons, and the *Paul Jones*, 1258 tons, all of which came out in the early 'seventies. Thus the construction of the Suez Canal reduced the field of operation for sailing ships in this direction, and hence indirectly injured the American shipping industry.

2

A new long-voyage trade was slowly developing, however, which was to cause the construction of the largest and most efficient square-rigged vessels ever to be built in Europe and America. This was the grain-carrying trade from the ports of the Pacific Coast to Western Europe by way of Cape Horn. This trade required a long off-shore voyage of some 14,000 miles through broad areas of fresh favorable winds, and consequently was highly suitable for the employment of sailing ships. During the heyday of this trade as many as 600 sailing ships, flying seven flags, found employment in it. The use of steamships on this route prior to

[5] Samuda, pp. 1–2; D. A. Wells, *Recent Economic Changes* (1890), pp. 29–30. Wells holds that the opening of the canal was of considerable significance.

[6] Lubbock, *The China Clippers*, pp. 309–327.

[7] Lubbock, *The China Clippers*, p. 346.

[8] Discussion, *Trans. I.N.A.*, XI (1870), 7–9.

the construction of the Panama Canal was rare, the number leaving San Francisco with grain for Europe in the four-year period ending June 30, 1885 being but 12, whereas the number of sailing ships was 1521.[9] As late as 1903 the grain fleet consisted of 215 sailing vessels and 15 steamers.[10] The freight payments, which amounted, for example, to $15,000,000 in 1882, alone made this an important business. It was in this trade that nearly all of the American square-rigged fleet of the post-war period found employment. Even the new names suggested the change, for *Harvester*, *Reaper*, *Granger*, and *Thrasher* supplanted *Electric Telegraph*, *Flying Cloud*, *Ocean Express*, and *Flying Mist*. This trade, therefore, was the principal field of operations of the American sailing marine.

The grain trade of the Pacific Coast developed with great rapidity between the loading of the first cargo on the bark *Greenfield* in 1855 [11] and 1890 as the result of a long period of bonanza farming in the fertile river valleys of California, where crop yields of high figures could be secured from the new rich soil. In California the quantity of cereals produced increased from 12,000,000 bushels in 1859 to 68,000,000 bushels in 1884, and on the entire Pacific Coast it rose from 14,000,000 bushels to 98,000,000 bushels.[12] By 1880 there were in California alone about 36,000 farms operating about 10,600,000 acres of improved land. The crops of the coastal area, for which there was no adequate local demand, were brought to the ports on San Francisco Bay, where about 75 per cent of the grain ships loaded, to those on the Columbia River and Puget Sound, and to smaller loading places, such as Astoria. Normally, exportation provided a market for a large proportion of the crop. Hence during the entire period grain movements in overseas trade increased rapidly. Between 1870 and 1879 they rose from 1,700,000 bushels to 25,000,000 bushels. The tonnage of the shipping clearing from Pacific Coast ports for Europe consequently showed a phenomenal expansion: in 1860 it was 1407 gross tons; in 1865, it was 43,302 tons; in 1871, it was 135,111 tons; in 1875, it was 359,307 tons and in 1880, it

[9] W. W. Bates, *American Marine*, p. 241.
[10] R.M.M.C., p. 1034.
[11] A. H. Clark, p. 254.
[12] Joseph Nimmo, "The Commercial, Industrial and Transportation Interests of the Pacific Slope," R.I.C., 1885, p. 19.

was 488,089 tons.[13] Approximately 90 per cent of the cargoes were discharged in British ports, and the remainder were chiefly unloaded in France, Holland, Belgium, and Germany. It was this growth which provided the chief source of demand for wooden sailing ships after the Civil War.

The vessels employed in this trade normally made but one round voyage a year. On arriving at San Francisco, Portland, or Seattle in mid-summer or fall they were placed in the highly competitive and speculative charter market, in which the numerous grain merchants formed the demand side.[14] Charters were generally made for a standard voyage to Falmouth or Queenstown (Cobh), which were convenient ports of call at which orders for any port in Europe could be issued. The ships were, in effect, floating warehouses, and the grain was often sold several times in the course of the voyage.[15] Charter rates were determined, on one hand, by the size of the crop, and, on the other, by the number of sailing ships in port or expected, although in the case of individual ships the insurance rate, which depended mainly on the ship's classification, caused differentials to appear. The fact that it was necessary to begin the outward voyage long before information regarding the state of the crop was available made it difficult to adjust the supply to the demand. The normal rates prevailing in this market were, nevertheless, largely determined by the cost of providing the service.

In this, as well as in most trades, a distinct separation between the shipping and commercial functions developed. The owners of the grain ships, as a rule, possessed no interest in their cargoes, and hence operated their vessels primarily to secure maximum profit from freights. The crisis of 1857, the Civil War, the increased regularity of shipping services, the growth of commercial specialization, and, above all, the savings to be secured by employing foreign tonnage, caused the complete disappearance of the old private trading ship on the majority of the sea routes in the third quarter of the century.[16] Consequently owners were forced to seek income directly in the highly-competitive freight

[13] Nimmo, "Shipping Engaged in the Trade of the Pacific Coast with Europe," R.I.C., 1884, p. 60.

[14] Nimmo, "The Grain Fleet of California," R.I.C., 1885, pp. 39–42.

[15] Nimmo, "The Grain Fleet of California," R.I.C., 1885, p. 42.

[16] State Street Trust Company, *Some Merchants and Sea Captains of Old Boston* (1918); Wells, pp. 106–107.

markets which developed under conditions of free navigation. The control of many of these vessels was placed in the hands of specialized shipping firms. Many of these were firms of managing owners, which acted directly or through numerous commission houses to secure charters, and which distributed the profits, after deducting their commissions of 5 per cent of the freight bill, among the 32, 64, 100, or 128 shares into which sailing vessels were generally divided. The old relationship between mercantile firms and shipping had thus disappeared, and the shipping industry was consequently even more competitive than before.

The vessels engaged in this trade were primarily dependent on the grain freights for earnings, and consequently the building of ships of this type fluctuated in sympathy with the state of the charter market. For instance, the depression in shipbuilding between 1871 and 1873 may be traced to the short crops and the sharp reduction in the grain movement from 10,000,000 bushels in 1869 to 4,000,000 bushels in 1871, while the boom from 1874 to 1878 may be attributed to the recovery of the export trade to 20,000,000 bushels in the former year and to the high level subsequently maintained. Westward cargoes were generally scarce relative to the demand for eastbound space, and consequently freight rates for shipments moving in this direction were usually at unremunerative levels. American sailing ships generally sailed from Europe to East Coast ports, where they loaded coal, rails, or other cargo at rates which, although unremunerative, nevertheless provided more cash, because of the navigation monopoly, than could be secured elsewhere. Beginning in the late 'seventies, however, many shipowners found it profitable to send vessels to China or Manila because of the rise, among others, of oil shipments to Far Eastern ports. Thence they crossed to the grain ports.[17] British and other foreign ships generally loaded coal directly for the grain ports at rates barely a fourth of those secured in the opposite direction. Some, however, went out by way of South America, Australia, or the Orient. An analysis of the grain fleet of 1882 showed that 44 per cent came from Europe directly, 15 per cent from eastern United States ports, 21 per cent from Australia, 5 per cent from China, and the remaining 15 per cent from

[17] R.I.C., 1885, pp. 40–41.

the East Indies, India, and South America.[18] The pattern of navigation was thus very complex.

3

The builders of wooden ships found that the construction of big ships for this carrying trade was the only part of their former large business of building deep-sea ships which remained profitable. For it they constructed larger and more economical full-rigged ships than had formerly been built. In fact, it may be said that during this period, which closed in 1914, the art of building wooden square-rigged ships reached its perfection.

A notable development in American naval architecture was the building of wooden grain ships which were three times as large as the typical freighters of the clipper-ship era. The owners, who were now assured of ample cargoes, required the most economical freighters that could be constructed, and this economy could be achieved best by increasing the size; for large vessels, in accordance with the principle of proportion, could be driven more easily at a given speed. They also behaved better in the heavy weather off Cape Horn, and required smaller crews in relation to their carrying capacity than smaller ones. During the clipper-ship period, as we have seen, the size of deep-sea freighters was about 1000 gross tons, although many were as small as 500 tons, and that of the clipper ships normally ranged between 1100 and 1300 gross tons.[19] For purposes of comparison, however, it appears that many of these latter craft were greatly overrated under the old admeasurement rule, as is shown by the fact that shrinkages of several hundred tons were recorded when the same vessels were remeasured under the new formula introduced in 1864, which provided for the careful measurement of the internal volume.[20] An extreme case is that of the celebrated clipper *Witch-of-the-Wave* — a very sharp vessel — which measured 1498 tons under the old rule, but only 997 tons under the new one.[21] The shrinkage was substantial in other cases as well, and hence it appears that the typical clipper ship measured little, if any, over 1200 tons by the new rule. The tonnage of the earlier full-built ships, however,

[18] R.I.C., 1885, p. 40.
[19] *Supra*, Chapter X, pp. 289–291.
[20] 13 U.S. Stat. 69 (May 6, 1864); amended by 13 U.S. Stat. 444 (Feb. 28, 1865).
[21] Howe and Matthews, *American Clipper Ships*, II, 727.

was only slightly affected by the alteration in the rule. Hence, it may be concluded that few wooden vessels exceeded 1200 gross tons prior to 1860.[22]

The advance in the art of ship construction is shown by the fact that the building of vessels of 2000 gross tons became a common achievement of some of the Maine builders in the 'seventies, and that a number of ships of 3000 tons came out in the 'eighties. These vessels were built by a limited number of yards, probably not over fifteen, where the technique of constructing big ships was perfected. The firms which were most notable in this development were the Bath yards of E. & A. Sewall, Houghton Brothers, Chapman & Flint, and Goss & Sawyer, the Thomaston establishments of Edward O'Brien and Samuel Watts, the Rockport firm of Carleton, Norwood & Company, and the Kennebunkport yard of N. L. Thompson. Taking the Kennebunkport district, for example, we find that the average tonnage of the full-rigged ships built rose from 992 tons during the years 1860–1864 to 1799 tons during the years 1875–1879.[23] The best indication of the rise in the size of the new American wooden grain ships, however, is the average tonnage of the vessels built in two outstanding yards, namely those of E. & A. Sewall and Houghton Brothers of Bath. Figures for these yards are given in the table on page 379.

[22] The following table covers a number of the noted clippers:

TONNAGE OF CERTAIN CLIPPER SHIPS UNDER THE OLD AND NEW RULES

Vessel	*Old*	*New*	*Vessel*	*Old*	*New*
Witch-of-the-Wave	1498	997	N. B. Palmer	1399	1124
Malay	868	821	Napier	1811	1424
Mary Whitridge	978	862	Nightingale	1060	722
Messenger	1351	1026	Non-Pareil	1431	1097
Midnight	962	838	Ocean Express	1697	1483
Morning Light I	1713	1589	Ocean Telegraph	1495	1244
Mystery	1155	1074	Orpheus	1272	1067
Neptune's Favorite	1347	1194	Panamà III	1139	687
Queen of Clippers	2361	2197	Rattler	909	853

[23] Bryant. The statistics of square-rigged ship sizes at Kennebunkport are as follows:

Calendar Years	*No.*	*Average*	*Largest*	*Name of Largest*	*Mast. Carp.*
1860–1864	18	992	1237	*Star of the Sea*	Abner Clark
1865–1869	8	1252	1365	*Mogul*	W. H. Crawford
1870–1874	10	1680	2516	*Ocean King*	B. Jackson
1875–1879	10	1799	2117	*Philena Winslow*	B. Jackson
1880–1885	1	1925	1925	*Reuce*	David Clark

Gross Tonnage of Wooden, Full-rigged Ships Built in Two Leading Yards [24]

Calendar Years	E. & A. Sewall No.	Average	Largest	Houghton Bros. No.	Average	Largest
1860–64	5	1080	1215	3	1174	1248
1865–69	6	1295	1764	4	1198	1234
1870–74	8	1503	1731	4	1436	1535
1875–79	8	1520	1712	3	1613	1698
1880–84	4	1925	2126	2	1974	2081
1885–89	2	2755	3054	0	....	....
1890–95	3	3031	3347	1	2495	2495

Some of the American grain ships became famous because of their great size. The *Ocean King*, a shipentine of 2516 tons which was built by Benjamin Jackson in N. L. Thompson's yard in 1874, was said at the time to be the largest wooden sailing ship ever built excepting the *Great Republic*.[25] The 'eighties and 'nineties, however, produced the best vessels. In 1884 John MacDonald, one of the foremost master carpenters of Bath, built the famous *Henry B. Hyde*, 2580 tons; in the same year the four-master *Frederick Billings*, 2628 tons was launched at Rockport; and between 1889 and 1892 E. & A. Sewall at Bath launched the four-masters *Rappahannock*, 3054 tons, *Shenandoah*, 3258 tons, *Susquehanna*, 2628 tons, and *Roanoke*, 3539 tons. The last named, which was the Sewall's ninety-fourth and last wooden ship, was the best and last effort of the American builders of wooden ships to compete with the European builders of iron ones in the construction of sailing vessels, and represented what her builders believed to be the maximum attainable size and efficiency in a wooden ship.[26] With a length of 300 feet on the keel, and 340 feet over all, and a carrying capacity of 5400 deadweight tons on a draft of 27 feet, she was probably the largest square-rigged ship ever built and sent to sea in the United States,[27] for McKay's *Great Republic* measured but 2751 tons, new measurement, and had a deadweight capacity of only about 4500 tons when she was rebuilt in 1854 after the fire which nearly destroyed her.[28] As

[24] Compiled from data in the Hall Report, p. 71.
[25] Matthews, *American Merchant Ships*, II, 247.
[26] Matthews, *American Merchant Ships*, I, 265–269; Basil Lubbock, *The Down-Easters, American Deep-Water Sailing Ships, 1869–1929* (1929), p. 186.
[27] Matthews, *American Merchant Ships*, I, 265.
[28] Howe and Matthews, *American Clipper Ships*, I, 256.

originally built, however, the latter vessel had had a gross tonnage of 4555, old measurement, and a deadweight capacity of 6000 tons.[29] It is apparent, therefore, that the wooden shipbuilders made a substantial advance in naval architecture.

4

In model the grain vessels were of a medium clipper type. The wasteful features of the extreme clippers of the 'fifties, especially the very sharp ends and heavy sail plans, which features had been seriously criticized by English naval architects in the 'sixties, were modified in order to secure an easy passage with large cargoes under normal weather conditions; but the advantages of these vessels, namely increased length, flat floors, and easy lines forward in place of the apple-cheeked bows, were retained. Furthermore, the reform of the admeasurement rule, effective in 1864, in which the British system was tardily adopted, freed American designers from any incentive to adopt full, deep, kettle-bottomed forms. The result was that the grain ships had long, level keels, relatively flat floors, raking bows, which were slightly convex at the waterline but quickly swelled out in a full, graceful curve, the greatest beam at about amidships, considerable length to the full-bodied section, fairly short but fair runs, and broad, raking, square sterns. They also had high bows, low waists, and a pronounced sheer, which features gave buoyancy and power in head seas. For speed, size and length were primarily relied upon. These vessels normally ranged between 200 and 300 feet in length, and the ratio of the length to the beam ranged between 5.4 and 5.8. These craft were thus big, powerful vessels, which were easily driven in ordinary weather by moderate sail plans. They were capable of approaching the passages made by the smaller but sharper and more costly extreme clippers. Vessels of the latter design were never built for this business. This new design, which had various modifications, appears to have been evolved almost simultaneously by numerous builders along the coast during the late 'fifties and 'sixties, although the Maine yards probably made the greatest contribution. In every respect these craft were an improvement over those of the pre-war years.

The grain ships were also masterpieces of the wooden shipbuilders' structural art. The severe strains imposed by the great

[29] Howe and Matthews, *American Clipper Ships*, I, 253.

size of the ships and by the severe weather encountered, on one hand, and the need for extreme economy in construction and for the use of a minimum weight of timber, on the other, created serious problems. Advantage was consequently taken of every form of bracing. The keelsons were made from 13 to 16 feet deep, and sometimes were even brought up to the lower deck beams; heavy iron plates were fastened to these keelsons in the midships portion; and heavy iron straps were fastened diagonally to the inside of the frames along the middle three-fourths of the length. The floors, which were usually of live or white oak, were generally laid solidly, and the frames, which were closely spaced and copper fastened, were of great size. In the best vessels the frames were fashioned of Maine, Virginia, Maryland, or western white oak, but in the interests of economy other woods, especially hackmatack, maple, and beech, were used in many cases. The planking, which was of southern pine, was from 5 to 6 inches thick and was square-fastened. Inside three decks were frequently laid, or at least the lower deck beams were fitted to give strength. In addition there were generally a poop and topgallant forecastle. Money was saved on the finish, however, by reducing the outside and inside joiner work to a minimum, and by using brass, teak, mahogany, and scrollwork sparingly. Unfortunately, in order to secure the necessary strength it was necessary to build a vessel which was of great weight relative to one of iron construction, and even so the natural physical limitations of wooden construction caused weaknesses. Furthermore, the cost of securing, hauling, and shaping the necessary 200 to 300 oaks of suitable size tended to rise. It was indeed evident during this period that structural limits in the use of wood were being approached, and that despite the exercise of much ingenuity it was impossible to keep pace with the improvements in iron ships.

The builders also made notable progress in devising the economical rigs which were essential for successful operation. This was done by subdividing the larger sails, improving the gear, abolishing the studding sails and other expensive "kites" of the clipper ship period, and in some cases radically altering the design. The tall three-masted skysail-yard ship rig, which gave the maximum sail area readily handled by an ordinary crew and was extremely fast in the heavy Cape Horn weather, was generally employed. The double-topsail sail plan, which had been origi-

nated by R. B. Forbes and by him used first on the *Midas*, *Massachusetts*, and *Edith* in the years 1844–1845,[30] and which had later been employed on the *Great Republic* in 1853 [31] and a few other ships, was now generally employed. It greatly reduced the labor of handling topsails, especially in heavy weather. Double topgallant sails, although common on English ships after 1870, were, however, infrequently used. As a rule American ships were still heavily canvased. The rigs were tall and narrow at the top in contrast to the shorter and broader ones of the European fleets. As for rigging, although British owners had adopted iron for their principal spars and iron wire rigging by 1870, American ships generally carried spars of Michigan or Oregon pine, which were heavier but cheaper, and hemp rigging, which, although weaker, heavier, less durable, and more costly to maintain, was nevertheless more inexpensive. The tariff on iron notably retarded the use of this material aloft.[32] American ships sometimes, however, secured iron lower masts and rigging on arrival in England.[33] The *Andrew Johnson* and *Edward O'Brien II* were perhaps the only American ships to have iron masts of domestic manufacture,[34] and the Bath ship *John R. Kelley* of 1883 was said to be the first to have steel ones.[35] The result of these changes was that the manning scale on full-rigged ships was substantially reduced from about three men per 100 tons in the 'fifties to about one man in the 'seventies and 'eighties, although, in part, this economy was unfortunately achieved by overworking crews which were "pressed" by the boarding-house masters.

Still further devices were adopted to achieve economy. On six [36] of the largest vessels the builders used the shipentine or four-masted-bark rig, which was frequently found in European craft. This rig permitted still greater subdivision. In general, however, it appears to have been unpopular, possibly because it was not fast enough. The three-masted bark rig, which was more

[30] Forbes, *Notes on Ships of the Past*, pp. 142–143.

[31] A. H. Clark, p. 236. A rig of somewhat different design, which later became the standard one, was devised by Captain Frederick Howes and used on the ship *Climax* of Boston in 1853.

[32] Statement of Paul Curtis, Boston shipbuilder, Lynch Report, p. 92.

[33] Statement of Paul Curtis, Boston shipbuilder, Lynch Report, p. 92.

[34] Hall Report, p. 99.

[35] Matthews, *American Merchant Ships*, I, 182.

[36] The *Great Republic*, *Ocean King*, *Frederick Billings*, *Susquehanna*, *Shenandoah*, and *Roanoke*.

economical to operate than that of a ship, was extensively used in the fruit, sugar, and other short-voyage deep-sea trades, but was rarely seen on vessels sailing around Cape Horn until the 'eighties, when the pressure to secure economy was very great.[37] Still more economical rigs, requiring but one man to 200 tons, were those of three-, four-, and five-masted barkentines, in which square-sails were retained on the foremast only. These vessels were fast with the wind abeam, but were slow sailers with the wind aft and were dangerous in heavy Cape Horn seas. Hence they were employed mainly in trades having steady beam winds and moderate weather, such as those of the Pacific. From a size of 300 tons in the 'fifties, the barkentines increased to over 1000 tons in the 'seventies. The output of vessels of this type reached its peak during the period 1868–1887, during which 116, totaling 53,601 gross tons, were built. In 1893, toward the close of the sailing-ship period, the 677 vessels of the American square-rigged marine comprised 186 shipentines and ships, 285 barks, 113 barkentines, and 93 brigs.[38] Ton for ton this fleet could be effectively navigated with between one-third and one-half the man-hours of labor of that of 1850.

5

These grain vessels were mainly built in the low-cost shipbuilding towns of Maine, where a rural economy, a supply of local timber, and, most important, the relatively low price of labor, which there remained in a backwater during this period of industrial development, made it possible to carry on the shipbuilding industry. Elsewhere the crisis, which began in 1857, brought a sharp decline if not a complete collapse in the building of wooden ships. In the 'seventies the output of deep-sea vessels was less than one half that of the 'fifties in the yards between the Piscataqua and Plymouth, insignificant along the southern New England coast, and almost zero at New York, Philadelphia, and Baltimore. In the yards south of Cape Cod, from New Bedford to Norfolk, where the decline was most severe, the output of ships and barks fell from ninety-two in 1855 to twenty-three in 1860, ten in 1865, five in 1870, and one in 1880,[39] and the decrease in

[37] Largest three-masted barks built are said to have been the *Guy C. Goss* and *Gerard C. Tobey*, 1572 tons, which were built at Bath by Goss and Sawyer in 1879. See Matthews, *American Merchant Ships*, II, 168.

[38] A.R.C.N., 1893, p. 144.

[39] R.C.N.T. for the years named.

value was even greater. Thus it may be seen that the shipbuilding industry southwest of Cape Cod was unable to survive under the new conditions.

At New York, where the decline in packet and clipper ship construction was particularly felt, the crisis was extremely severe, the output of ships and barks falling from forty in 1855 to twenty-four in 1856, twenty-eight in 1857, seven in 1858, two in 1859, and zero in 1862. Subsequently only a few such vessels were built, the output for the periods 1865–1869 and 1870–1874 being only twenty-six and thirteen ships respectively. By 1870 many of the shipbuilders had gone bankrupt, abandoned the business, or confined themselves to repair work. Those remaining, such as W. H. Webb and Jacob Westervelt, lost a good deal of money on much of their business because of the low prices at which Maine-built ships sold in the New York market.[40] The cessation of the demand for high-class ships, in which the New York yards had specialized, was, indeed, a severe blow, for in cost alone competition had been impossible for some time. The launching of the last Black Ball passenger ship, the *Charles H. Marshall*, 1633 tons, from W. H. Webb's yard in 1869 marked the close of this type of business.[41] By the end of the 'seventies the construction of vessels of all types had practically ceased, the yards had been converted to other purposes, and the shipwrights had scattered.

A similar collapse occurred at Philadelphia, where, although the industry had been dying, it had turned out twenty-nine ships and barks during the boom years 1851–1856, and at Baltimore, where some five yards had built an average of fourteen ships and barks annually during the period 1851–1857, besides a number of brigs and schooners. There was also a sharp decline at Norfolk, where, after some activity during the 'fifties, building entirely ceased; in the whaleship-construction centers of New Bedford, Bristol, and New London; and at Providence,[42] Mystic, Fairfield, and other commercial shipbuilding centers of the southern New England coast.

North of Cape Cod, where conditions were more favorable, construction was curtailed, but not stopped. In the Boston dis-

[40] Statement of W. H. Webb, Lynch Report, p. 38.

[41] J. H. Morrison, *History of New York Shipyards*, pp. 162–164.

[42] See Providence Institution for Savings, *Ships and Shipmasters of Old Providence* (1919).

trict large freighters for the grain and East India trades continued to be built in considerable number at Medford,[43] East Boston,[44] and Quincy. At Newburyport and Portsmouth also a number of yards continued in operation until the later 'seventies, although vessel prices were unprofitable, the former prosperity had gone, and comparatively few ships were constructed.[45] At Plymouth, Duxbury, Hanover, Scituate,[46] Salem, and Marblehead the construction of large vessels ceased almost entirely. In general, shipbuilding in these regions was quite depressed, but it did not entirely cease.

In Maine, however, the crisis was much less severely felt, for considerable business was done in constructing freighters for American, British, and French owners. The total tonnage built, which consisted almost entirely of sailing vessels, fell from 215,905 gross tons in 1855 to 49,905 tons in 1859, and to 26,264 tons in 1862, but recovered to 89,015 tons in 1867 during the first post-war boom.[47] The greater part consisted of deep-sea ships and barks, of which 593 were built during the years 1855–1859, 254 during the war period 1860–1864, and 255 during the period 1865–1869.[48] Maine thus became the chief source of supply of square-rigged ships: that state's proportion of the total number built rose from 51 per cent during the California boom to 80 per cent by 1875.[49]

[43] Gleason Hall, "Old Ships and Shipbuilding Days at Medford," *Medford Hist. Register*, XXXIV (1931), 56. The builders were J. O. Curtis, whose last ship was the *Cashmere*, 936 tons, built in 1869; and J. T. Foster, whose last was the *Pilgrim*, 957 tons, built in 1873.

[44] The important East Boston yards were those of Samuel Hall, Donald McKay, Campbell & Brooks, Smith & Townsend, and R. E. Jackson.

[45] Currier, pp. 37, 78, 90.

[46] Briggs, p. 145. The last vessel was built on the North River in 1869.

[47] R.C.N.T. for the years named.

[48] Compiled from R.C.N.T. for the years named.

[49] R.C.N.T. The number of ships and barks built in various sections of the coast in certain years is given below:

Fiscal Years	*Norfolk–Del. R.*	*New York*	*Fairfield–New Bedford*	*Plymouth–Portsmouth*	*Kennebunk–Eastport*
1850	24	26	11	56	127
1855	28	40	24	68	213
1860	10	4	9	33	53
1865	1	4	5	21	74
1870	0	4	1	21	43
1875	1	2	2	21	81
1880	9	0	1	0	15

Shipbuilding activity was general during the 'sixties and 'seventies throughout the State of Maine, but the leading centers were the customs districts of Bath, Waldoboro, Portland, and Belfast. For instance, in 1875, an active year, the number of full-rigged ships built in each of these districts was respectively 25, 14, 13, and 12. In addition, there were built in the less important districts of Kennebunk, 3; Wiscasset, 1; Bangor, 3; Machias, 8; and Eastport, 1.[50] Boston and Bath became the principal centers in the United States for this type of construction, for in each district in the fifteen-year period, 1860–1874, 198 ships and barks were built, compared, for instance, with 83 at Waldoboro, 43 at New York, 49 at Newburyport, and 27 at Portsmouth.[51] At Bath in the 'seventies some fourteen shipyards lined the Kennebec, and there were others down-stream at Phippsburg, and upstream at Richmond, Bowdoinham, Augusta, and other towns. The business of constructing wooden sailing ships, indeed, reached its greatest vigor and excellence in the post-war period on this river because of the continued existence of a local timber supply, the skill of the master carpenters, and the strong leadership of some of the principal firms. Elsewhere the industry was more dispersed. Bath, indeed, was the shipbuilding capital of the country after the Civil War.

6

The preservation of shipbuilding along the Maine coast may be attributed primarily to lower labor costs. In the "country yards," where the clipper-ship boom had been less strongly felt than elsewhere and where the emphasis had been placed on cargo ships, labor costs had been less strongly affected than in New York, Boston, and other centers. In the latter centers, labor, which was organized, secured relatively high rates, generally between \$3.00 and \$4.00 per day on new construction,[52] and a limitation of the working day to eight or nine hours. Labor costs were also determined by the general rates of pay and conditions of work prevailing for skilled mechanics in these areas, and especially by the rates paid in the navy yards. At New York a ten-week strike involving 5000 men occurred in 1866. In contrast,

[50] R.C.N.T., 1875.
[51] Compiled from R.C.N.T. for the years named.
[52] Lynch Report, pp. 41, 85.

the labor supply of the Maine yards was to a large extent drawn from farms, faced lower living costs, was relatively immobile, and only indirectly felt the influence of industrial and agricultural expansion. The supply was generally ample and was unorganized. Consequently labor costs readily fell under pressure. Although no comprehensive figures are available, it appears that the level of rates remained between 25 and 50 per cent below that of the other areas, and, in addition, the working day was usually ten hours, and in some cases, from sunrise to sunset as formerly. The advantage of the eastern yards may, therefore, be attributed chiefly to the fact that the labor supply consisted of a low-cost, non-competing group.

The state of the timber supply was one of general exhaustion all along the coast, except in isolated places. The new big ships required from 200 to 300 great oaks for their construction, and such trees were becoming rare on the northeastern seaboard. Difficulties in securing the accustomed supply from local or interior sources were consequently encountered during the 'seventies at such shipbuilding centers as New York, Newburyport, Portsmouth, Kennebunkport, Wiscasset, Damariscotta, and the Penobscot towns. Timber was still cut, however, in considerable quantity along the Kennebec, and in the vicinity of Thomaston and Waldoboro for a decade or two more. Consequently, to a considerable degree resort was had to distant virgin forests, especially after the active period of construction in the 'seventies. Thus the shipbuilding process, which had formerly involved merely the fashioning of local materials which were secured quickly, easily, and cheaply, now required the assembly of materials from many distant places at considerable cost.

The heavy frame pieces now frequently required transportation over long distances. White oak, which was still employed in all first-class ships, was secured more and more from the coastal and interior regions of Maryland and Virginia, where considerable stands were still to be found, from the newer regions of the Ohio Valley, where the forests were being cut with great speed, from the Lake States of Michigan, Wisconsin, and Minnesota, and from Ontario. Comparatively new functionaries, the timber contractors, who frequently were former shipbuilders, appeared. These men made agreements to secure the oak frames for a vessel. To do so they took either the plans of the ship or

the light builder's molds for the frames into the woods, where suitable pieces were cut to the required shapes, numbered, and sent to the yard. Sometimes, however, the master builder himself undertook this work. Live oak from Florida, which was also obtained by contractors, again came into use as a floor timber because of the rise in white oak prices. To obviate delay a considerable supply of timber was kept on hand seasoning in some yards, but in general this was not done. The result was that the complete shipbuilding process was lengthened considerably, sometimes by as much as a year.

Other pieces also came from considerable distances. The knees were of hackmatack or spruce cut in northern Maine or New Brunswick and thence shipped coastwise by schooner. The hardwoods, maple, beech, and birch, which were sometimes employed in the top timbers and even in the keels, floors, and lower futtocks of second-grade ships, were also secured primarily in the interior of Maine and Canada. Much of this shipbuilding material was cut in northern Maine, but was shipped down the St. John River to the sea and thence was imported duty free. The planking was generally of southern hard pine, although western oak was sometimes used. Great white pine masts were no longer available locally, and recourse was therefore had to the white pine of the Lake States, the hard pine of the South, to built-up masts banded with iron, and, in the 'eighties and 'nineties to Oregon pine. More and more, American sailing ships contained woods assembled from widely separated areas of the country.

Some of the eastern yards secured a considerable advantage in cost as long as their local supplies were sufficient. There was a wide variation in timber prices between yards. It may be estimated that in those ports where a local supply could still be had a saving of from 15 to as much as 40 per cent in comparison with other yards was experienced. This differential was a powerful force aiding the eastern builders as a group. Although distant supplies could be economically secured by coastwise schooner in many cases, it was impossible to reduce the costs of shipment to a level at which such timber could compete with abundant local stock, even though the latter might have to be hauled from fifteen to twenty miles. Hence as the local supplies diminished in amount the advantage of the Maine builders on this account decreased, and the general level of construction costs tended to rise.

The shipyards of Maine set the national price level for wooden sailing ships. In 1869, for instance, the cost, including a fair income to the builder, of a 1000-ton full-rigged ship was estimated to range between $110 and $90 per ton at New York, $110 and $80 at Boston, $80 and $75 at Waldoboro, Thomaston, Portsmouth, and Portland, and $70 and $60 at Bath, Kennebunkport, and Searsport.[53] A considerable variation in the quality, construction, model, finish, and outfit probably existed between these centers, however, and hence the figures cannot be considered to be strictly comparable. For instance, vessels heavily built of oak, copper-fastened, and coppered, masted with Oregon pine, and equipped with a double outfit cost from $10 to $25 more per ton than those of mixed woods, fastened with iron, fitted with built-up masts, and supplied with minimum equipment. Even making allowances for such differences in quality, however, it is clear that during the last half of the century many districts in Maine could build considerably more cheaply than other areas.

Although the difficulties of securing materials continued to multiply, the cost of building vessels does not appear to have risen greatly after 1860. Because of the nature of the industry, the trend of prices and costs is, however, very difficult to trace. From a range of between $50 and $60 per ton for cargo ships in Maine ports in 1860,[54] prices appear to have risen to between $65 and $80, currency, in 1870,[55] and appear to have remained in this range during the active period of grain-ship construction which ended about 1878. Following the appearance of severe competitive pressure from abroad after 1878, however, prices and costs appear to have fallen somewhat because of reductions in wage rates and the general elimination of profits. Most of the ships built after this time were for the builders' own account, and contract work practically ceased. Hence the figures available later are probably not comparable to the others. These figures, which are chiefly from the Kennebec area, show costs per ton generally lying between $50 and $60. Thus we may conclude that although labor and material prices trended upward at first, and that the prices of ships rose as a result, nevertheless strong

[53] Statements of shipbuilders and customs officers, Lynch Report, pp. 15, 24, 41, 42, 91, 132, 195, 212.

[54] Lynch Report, pp. 195–198; Hall Report, pp. 103–105.

[55] Lynch Report, pp. 41–42, 91.

pressure and some economies caused a reduction again during the latter part of the sailing-ship period. This reduction, however, was largely at the expense of the profits and capital of the builders and the earnings of the workmen. The fact that the Maine yards, despite the undoubted increase in real costs which they faced, were able to secure these reductions in ship prices indicates the susceptibility to pressure of a small competitive industry supported by relatively immobile labor and capital resources.

7

The organization of the shipbuilding industry changed somewhat during this period as a result of the financial stringency in maritime circles following the crisis of 1857, the increased size and cost of vessels, and the diminished importance of the sailing-vessel markets. Instead of being operated by small master carpenters or in the case of the larger establishments by firms of independent master builders, as formerly, many shipyards were now controlled by financial interests, which were often shipowning houses or firms of managing owners, and which hired one or more master carpenters to supervise construction. The yards came to be of two types, namely, the private ones, which were operated by some of the large Maine sailing-ship houses chiefly or solely for the construction of ships for their own accounts, and the contract ones, which built ships for others on contract or on speculation.

The former type was the most important, for the American flag was chiefly shown in foreign ports on vessels of the big Maine firms, most of which operated their fleets out of New York and Boston. Among the most important of these firms were E. and A. Sewall, Chapman & Flint, Houghton Brothers, and Patten & Company of Bath, C. V. Minott of Phippsburg, Samuel Watts and Edward O'Brien of Thomaston, A. R. Reed of Waldoboro, Blanchard Brothers of Yarmouth, Soule Brothers of Freeport, Pennell Brothers of Brunswick, Skolfield Brothers of Harpswell, Carleton, Norwood & Company of Rockport, and William McGilvery of Searsport. Very large fleets of vessels were built and operated by some of these houses. For instance, the Sewall firm of Bath, which was probably the outstanding American enterprise of this type, built in their own yard thirty-seven ves-

sels between 1864 and 1882, of which thirty were full-rigged ships or barks.[56] By 1892, after about three quarters of a century of existence, this firm had constructed, principally for its own use in the cotton, grain, China, and Hawaiian trades, no less than ninety-four wooden sailing ships. Subsequently they also built at Bath a number of steel ships. Patten & Company also had built about sixty vessels for their fleet by 1882. Another house, the firm of Pennell Brothers, had built sixty-eight ships down to 1874 when the *Benjamin Sewell*, their last ship, was launched.[57] The integration of the shipping and shipbuilding industries had existed before the Civil War to some extent, especially in Maine, but it had never been as prominent a feature of organization as now. Shipbuilders had not then attempted to manage ships, although many took shares in vessels. In the period after the Civil War, however, economies and increased security could apparently be attained by integration. Consequently this type of firm came to the fore.

The yards building deep-sea vessels on contract were therefore less numerous and active during this period. These firms were located chiefly at New York, Boston, Newburyport, Portsmouth, Kennebunkport, and Bath, in the last of which there were five establishments in 1882.[58] Among the largest of these were those of William Rogers and Goss & Sawyer at Bath, and Nathaniel Thompson[59] and Titcomb & Thompson at Kennebunkport. These enterprises depended on the shipowners still operating sailing vessels for their market, and the demand was, in general, irregular. Vessels were preferably built on order, but in many cases they were constructed on speculation and sent to New York or Boston, or even abroad to be sold. In some cases the builders promoted their vessels themselves by selling shares to local investors who were interested in maritime property or who desired contracts connected with the construction. Frequently builders appear to have required subscriptions from the contractors and workmen employed, and the sub-contractors likewise passed on some of their shares to their employees and others.[60] Thus the

[56] Hall Report, p. 71.
[57] Rowe, pp. 128–130.
[58] Hall Report, p. 101.
[59] M. J. Thompson, *Captain N. L. Thompson and the Ships He Built, 1811–1889* (1937), *passim*.
[60] Oral statement of Abner Chick of Kennebunkport.

lumbermen to get a market for their timber, the ship mechanics to secure employment, the ship chandlers to find a sale for their equipment, the shipmasters to practice in their profession, the shipbuilders to get the business, and the managing owners or agents to obtain freight commissions all combined to build, own, and operate vessels.[61] A large proportion of the population of a town thus might become interested in a ship.[62] This system was a means whereby employment was secured in the absence of definite orders, but, although profits were made on occasion by all concerned, losses frequently resulted, especially after 1878, when foreign competition became severe. Hence the result was that the remuneration of many of those employed on vessels was reduced, sometimes substantially. In some cases it was necessary for the builders to operate the vessels or to retain a substantial interest for a number of years before a sale could be arranged or financed. Hence at times it is difficult to distinguish between the private and contract yards. The contract yards were basically in a poor position because the majority of the small shipping enterprises to which they sold were financially weak and were on the margin of liquidating or investing in foreign-flag vessels.

During this period the economic position of the master carpenter declined notably. Whereas formerly he had usually been an independent entrepreneur and had attended to the technical and economic details of his business, he now frequently became merely a foreman or sub-contractor, who might be one of several hired by the owner of the yard to model and supervise the construction of vessels. For instance, it appears that N. L. Thompson employed about seven master builders between 1860 and 1876.[63] Nevertheless, some of these master carpenters achieved a considerable professional reputation, among those especially notable being John MacDonald, who was the designer and builder of many big ships, among which were the noted Chapman & Flint

[61] Lynch Report, p. xii.

[62] Statement of Giles Loring, shipbuilder and owner of Yarmouth, Maine, Lynch Report, pp. 145–146; statement of Ambrose Snow, shipowner, Farquhar Report, p. 4.

[63] Bryant. Benjamin Jackson built the ships *Hamilton*, *Ocean King*, and *Defiant*; W. H. Crawford, the ships *Republic*, *Mogul*, *Empire*, and *Columbus II*; Ira Grant, the ship *Alaska*; Mark Pool, the ship *El Dorado*; Clement Littlefield, the steamship *Franconia*; Stephen Ward, the ships *Staffordshire* and *Sterling*, barks *Eagle Delhi*, and *Sovereign*, and some smaller vessels; and David Clark, the *Columbus I*.

vessels *A. G. Ropes* and *A. J. Fuller.* Some master carpenters now built in succession for a number of firms, and even on occasion constructed small craft on their own account. The independent position which they had formerly enjoyed was difficult to maintain, however, because the rise in the costs of vessels from, say, $20,000 for a 500-ton ship in 1830 to $55,000 for one of 1000 tons in 1850 and $140,000 for one of 2000 tons in 1870 required more capital than such men usually possessed, or could easily raise under the conditions then prevailing. A form of organization similar to the putting-out system in the old cloth industry therefore arose.

Pressure to reduce costs also caused an alteration in the type of organization within the yard. The taking of apprentices, which had been general during the first half of the century, practically disappeared,[64] with the result that the standards of quality in shipbuilding deteriorated. Apprenticeship appears to have been too costly both for the masters and boys. In the Maine yards the special training necessary to set up vessels was in general either acquired by observation and study or by instruction imparted by fathers or other relatives. It was also necessary to utilize a relatively unskilled labor supply. As early as 1856 the shipbuilding trades in New York had been opened to unapprenticed mechanics,[65] and similar changes soon occurred in other places where restrictions existed. A marked deterioration in the quality of the labor supply seems to have subsequently occurred at New York and other places, with the result that shipbuilding was less efficiently conducted.[66]

The practice of letting out most of the work to sub-contractors was consequently extended. These sub-contractors were generally skilled independent foremen, who specialized in particular types of work, provided their own helpers, trained their men in the particular operations to be performed, and brought their own tools. These small bosses usually had their own gangs and moved from

[64] Statement of Jacob Westervelt, New York shipbuilder, Lynch Report, p. 40. He says: "Twenty years ago it was the custom of each shipbuilder to educate a certain number of boys to the business, and to make them familiar with the mysteries of shipbuilding; but I believe that there have been no apprentices taken for many years past."

[65] "Difference of Expense of Repairing Vessels at Boston and New York," *R.B.B.T.*, 1856, p. 7.

[66] Lynch Report, p. 40.

ship to ship and often from town to town as well. The size of the gangs varied from about three men in the case of a joiner to perhaps ten in the case of a planker.[67] Soon in many yards the planking, fastening, joiner work, laying of the decks, fitting of the ceiling, blacksmith work, spar making, painting, and rigging were being let out in this manner.[68] In others, however, labor was directly hired by the builders as formerly. The frame timber was, as we have seen, commonly obtained by a timber cutter or contract. Thus the master carpenter was left with the tasks of modeling, setting up the frame, launching, and general supervision.

An interesting list of the firms concerned with shipbuilding at Kennebunkport in 1874 shows, for example, that there were five shipbuilders and contractors, eight master carpenters, six smiths, five joiners, five painters, three fasteners, two caulkers, two riggers, two sailmakers, two makers of pumps and blocks, one maker of spars, one builder of ships' boats, one constructor of tanks, one iron founder, one brass founder, and one fitter of tin ware.[69] These were all, with the exception of the shipbuilders, very small firms. The great advantage of the sub-contracting system lay in the fact that it was possible to use efficiently a large unskilled and semi-skilled labor supply, which could be secured at low wages. These men needed to learn but one operation, and by constant practice learned to perform it with speed and excellence.[70] The boss contractors, however, rarely earned over two or three dollars a day more than the men. In this way a considerable saving in the costs of construction was achieved.

8

The process of ship construction in the yards building wooden ships remained, as formerly, a handicraft one employing much direct labor. Although mechanization, large plants, and much specialization were arising in the industry of constructing iron vessels, little improvement was made in that of building wooden vessels. Steam sawing equipment, which we have seen was developed in the 'forties and 'fifties, was installed in many of the large yards in Maine. The first plant set up at Bath, in fact, came from McKay's yard at Boston in 1869 after his bankruptcy.[71]

[67] Oral statement of Abner Chick.

[68] Hall Report, p. 103.

[69] Bryant.

[70] Hall Report, p. 103.

[71] Hall Report, p. 87.

Such machinery enabled the labor of cutting and beveling the frames, perhaps the heaviest task, to be reduced by about a sixth. Planking was also cut, tapered, and beveled in a mill in most cases. There were in use also treenail machines for the cutting of fastenings, improved devices in the blacksmith shops, and steam winches instead of horses for the lifting of heavy pieces.[72] The main part of the work was still done in the open, as formerly. In most yards, however, large sheds, open at one side, were provided for hewing and fashioning in bad weather. Although the large private and contract yards were in the main well provided with such equipment,[73] there were many smaller establishments engaged in the construction of both large and small vessels where the hand methods of the first part of the century remained in use.[74] The problems of fixed charges, price cutting, and securing full utilization at plant, which were currently vexing the builders of iron ships, were largely absent in these establishments. The industry thus remained small in scale in comparison with those arising in other lines of endeavor, and simple competitive conditions continued to exist.

One problem received particular attention. The builders of wooden ships, unlike those of iron vessels, were hampered during the last half of the century by the scarcity of pieces with suitable curves for frames. Hence, a device for bending straight and other pieces successfully would have considerably reduced costs of construction. Experiments were consequently made with steam boxes and powerful clamps by J. W. Griffiths and others. Bent frame timbers were placed in the steamship *Ocean Bird*, which was built by Griffiths at New York in 1853,[75] the sloop-of-war *Pawnee*, which was built at Philadelphia in 1858, and the post-war Indiaman *New Era*, 1147 tons, which was built at Boston in 1870.[76] The frames of the latter ship are said to have been of one piece from keel to rail. Unfortunately, although this ship performed well, the process was cumbersome and costly, and was not generally adopted. Thus it proved to be impossible to imitate successfully the technique of the builders of iron vessels.

[72] Hall Report, pp. 86–87, 103.

[73] "The Present State of Shipbuilding in Maine," *Report of the Maine Bureau of Industrial and Labor Statistics*, 1900, p. 48. (This source is hereafter cited as M.B.I.L.S.)

[74] Hall Report, p. 87.

[75] J. H. Morrison, *New York Shipyards*, p. 151.

[76] Hall Report, p. 95.

One feature of the shipbuilding industry which was of some importance was the relatively high speed at which wooden tonnage could be put afloat compared with the time required in building iron ships. Once the materials were in the yard, between four and five months sufficed to complete the hull of the average ship or bark. This represented only a small increase over the time required earlier in the century. Even the hulls of the largest vessels rarely required more than six months. For instance, the keel of the great schooner *Eleanor A. Percy*, 3401 tons, was laid in March, and the launching took place in October.[77] In most cases from twenty-five to fifty men were required to build a ship with normal dispatch, although at times from two to five men would undertake to do the job over a much longer period. Hence, although builders often misjudged the market, the long lag between the initiation of a project and its completion, which was later to cause difficulties, was absent.

We have now traced the development of the industry of building wooden ships in the United States. Conditions of increasing real cost have been shown to have existed, although they were offset in part by economies. There was pressure on labor and capital to accept low returns. It now remains to trace the revival of keen international competition on the long sea routes followed by the grain ships.

[77] M.B.I.L.S., 1900, pp. 51–52.

CHAPTER XIII

INTERNATIONAL COMPETITION IN THE LONG-VOYAGE TRADES AND AMERICAN NAVIGATION POLICY, 1863–1914

I

FOLLOWING THE CIVIL WAR that portion of the merchant marine which was employed in the foreign carrying trades found itself in a new economic environment. The situation of the owners of square-rigged ships was somewhat different, however, from that of the steamship operators. It seems best, therefore, to leave the discussion of American steam navigation to a later chapter, and to concentrate attention on the position of the sailing-ship fleet engaged in the unprotected foreign trade.

Throughout the period from the Civil War to 1914 the sector of sailing-ship navigation in world trade was narrowing, but it remained important until the close of the century. The economic analysis of events in this sector is extremely significant because the comparative simplicity of the economic forces operating enables the influences of circumstances and policies to be more readily traced than in the sector of steamship navigation. This simplicity is due to the fact that a high degree of competition prevailed because of the prevalence of small economic units in shipping and shipbuilding, the passive attitude of the owners toward shippers, the active charter markets, and the absence of heavy overhead costs, on one hand, and of the relative absence of serious intervention by governments on the other. Large and complicated subsidies did not become an important disturbing influence until the end of the period. Hence normal supply conditions largely controlled the outcome.

This sector was also important so far as the United States was concerned because the American sailing-ship fleet in foreign trade was of much greater size and carrying capacity than the steam marine so employed until early in the twentieth century. For instance, it was estimated that in 1869 $34,000,000 in freight charges were obtained by American ships in foreign trade, of

which $32,000,000 were secured by sailing vessels.[1] The American sailers were estimated to have secured 48 per cent of the freight money paid to sailing vessels in American foreign trade, but the American steamers secured only 2 per cent of that paid to steam vessels. The gross tonnage of the registered sailing fleet was greatly in excess of that of the steam fleet of this time, the figures being 1,353,170 gross tons and 213,252 gross tons respectively, and, in fact, they remained larger until 1902.[2] Indeed, as late as 1901, the total distance covered by American sailing ships in foreign trade amounted to 3474 billion gross-ton miles, whereas that covered by American steam vessels was but 981 billion gross-ton miles.[3] It is apparent, therefore, that the development of the square-rigged marine was of major importance in the United States.

Because of the fact that the American owners of sailing ships were unable to secure foreign-built vessels, the changes which occurred in the relative cost levels of shipbuilding at home and abroad were of the greatest importance. The chief cause of concern to American owners of square-rigged vessels was the development of the cheap iron vessel in Great Britain, which development was very rapid after 1860. Engineers had, in fact, long recognized that the use of iron would not only provide stronger and more durable vessels, but would also go far to secure the supremacy of British builders and owners. Indeed, to accomplish this purpose the Institution of Naval Architects was established at London in 1860.[4] Hence severe international competition between wooden and iron vessels rapidly developed.

Experiments in the construction of iron hulls began early in the nineteenth century. The improvements in the iron manufacture made by Cort in the eighteenth century and the development of methods of rolling wrought-iron plates made the iron hull technically possible. Subsequently, in the late eighteenth and early nineteenth centuries, iron canal boats were built by iron masters in England and Scotland. In 1822, an English iron master, Aaron Manby, built a small steamboat of iron, named for himself, which

[1] Nimmo Report, p. 34. [2] A.R.C.N., 1914, p. 172.

[3] A.R.C.N., 1901, p. 333. The number of net-ton miles would be approximately 40 per cent less in the case of the steamships.

[4] John Grantham, "On the Classification of Iron Ships," *Trans. I.N.A.*, II (1861), 130.

was put together on the Thames and navigated to France. Other small iron steamships soon followed for use on the canals and rivers, but as yet iron had not appeared on the deep-sea routes in competition with American wooden vessels.[5] The first iron sailing ship to be employed in the oceanic trades was the small bark *Ironsides*, 271 gross tons, which was built at Liverpool by Messrs. Jackson & Gordon in 1838 and subsequently performed well on her maiden voyage to Brazil.[6] This voyage clearly showed the possibilities of iron as a material for both sailing and steam vessels.

Subsequent progress in the development of the iron sailing ship was rapid between 1840 and 1860. The British builders of wooden ships, as a first step, learned to use iron knees, pillars, and reinforcing pieces. From this use of iron it was easy to evolve the composite ships of iron frames and teak planking, which as we have seen proved to be very successful in the China trade. Although it was cheaper to build this type of vessel in England than one of wooden construction, the cost was too high to enable such vessels to compete generally with American and Canadian wooden ones except in the tea trade.[7] Hence the improvement of design and of the process of construction of iron vessels was of the utmost importance to the British shipbuilding industry. Many noted engineers and iron masters contributed to the accomplishment of these tasks. Foremost among these were William Fairbairn, John Grantham, and I. Brunel. All aspects of the structure, fastenings, size of angles and plates, strength of materials, and methods of work were investigated and discussed in the technical journals. The iron masters soon provided larger and longer plates, and the shipbuilders developed better forms of construction for their ships. Double-bottoms, which soon became standard, were devised and were first employed in 1844 in a small bark, the *Q.E.D.*[8] Brunel's pioneer Atlantic liner *Great Britain* of 1844 had watertight bulkheads dividing the hull into five parts.[9] She was the first large ship so built. Doubts concerning the strength of iron hulls were soon set at rest, first by the stranding of the coastwise steamship *Gary Owen* in 1834, and later, in 1846, by the stranding of the *Great Britain*.[10] Both ships were hauled off

[5] Clapham, *Economic History of Modern Britain*, I, 439.

[6] J. H. Ritchie, "Introduction to Lloyd's Revised Rules," *Trans. I.N.A.*, IV (1863), 290.

[7] Pollock, pp. 42–43.

[8] Fletcher, pp. 211–213.

[9] Fletcher, p. 223.

[10] Fletcher, pp. 196–197, 225–226; Pollock, p. 36.

exposed points undamaged, the latter after eleven months of pounding. Most important of all, progress was made in the difficult task of establishing sound practices in respect to the sizes of frames and plates, fastenings, spacing of frames, and other aspects of design. By 1854 a special committee of Lloyd's Register was able to draw up the first general rules for the classification of iron ships.[11] These were subsequently discussed, and were thoroughly revised in 1864 in the light of experience. By 1860, therefore, the experimental stage was past and the builders were prepared to produce both iron sailing ships and steamers for the world carrying trades.

Iron sailing ships consequently began to appear in large numbers in the latter 'fifties, and were well received by merchants and owners.[12] In 1853 there was built an iron Indiaman, the *Martarban*, which received a diploma for a perfect cargo-damage record — a significant event.[13] Furthermore, in the China trade, the iron ship *Lord of the Isles* made the best tea passage of 1855, thus proving that iron ships could sail.[14] The tea clippers *Black Adder* and *Halloween*, which came out in 1870, also were of iron. Iron sailing ships also supplanted wooden ones in the Australian, cotton, and East Indian trades, in which tightness of hull was important. Iron lower masts and yards, which were lighter and cheaper than American pine or Baltic fir, were introduced in steamships as early as 1834, and later also in sailing ships.[15] These were supported by iron-wire rigging set up by turnbuckles, which was stronger and more durable than tarred hemp. Work was also done to develop bottom paints which would check the serious fouling encountered on iron vessels. Hence by 1860 British shipbuilders were in a position to offer a well-designed and well-built vessel entirely of iron construction.

2

British shipyards were in a position to construct sailing vessels of this type economically, and soon secured conditions of decreas-

[11] Ritchie, pp. 289–290.

[12] Report of F. H. Morse, Consul-General at London, Lynch Report, p. 218.

[13] Lubbock, *The Colonial Clippers*, p. 200.

[14] A. H. Clark, p. 209; Lubbock, *The China Clippers*, pp. 125–126.

[15] E. J. Reed, *Shipbuilding in Iron and Steel*, p. 259; Charles Lamport, "On the Construction and Support of Iron and Other Masts and Spars," *Trans. I.N.A.*, IV (1863), 124–129.

ing cost. Behind them was the iron industry, which was growing at an extraordinary rate, and could produce iron at prices as yet rivaled by no other nation. In Scotland, in particular, the industry expanded, for the invention of the hot blast by James Neilson in 1828 enabled the coal of Lanarkshire to be used without coking, as a result of which large savings were made. Throughout the British Isles, coal, the most important resource in the iron and steel industry, was available, and although the mines were becoming deeper, the improvements in the technique of mining more than offset any resulting disadvantages. The size of the blast furnaces and of the iron-making establishments was also increasing, with the result that economies of scale began to become significant. The engineering trades, too, had reached a stage at which they could readily produce the relatively simple heavy equipment then required in yards building iron vessels. Most important of all, capital, skilled labor, and leadership in iron working were available in abundance.

It was inevitable, therefore, that the descending curve of prices of British iron ships should cross the rising one of the prices of American wooden vessels. In the case of steamships this intersection occurred at an early date prior to the Civil War, but in that of sailing vessels it happened during the critical decade of the 'sixties. By 1860 the prices of high-grade wooden and iron square-rigged ships had become approximately equal in Great Britain. Fourteen-year wooden vessels were then priced at from £16 16*s*. to £18 18*s*. per gross ton, and twelve-year iron ones from £17 to £18 per gross ton.[16] By 1869, however, the prices of the latter had fallen to between £13 and £14 per ton,[17] at which level they were but little, if any, higher than those of Maine-built wooden sailing ships of a similar type. Composite vessels were somewhat higher, costing owners between £13 and £16 per ton.[18] Subsequently, during the period of rapid expansion in sailing-ship navigation from 1873 to 1878, the prices of iron ships tended to rise somewhat, but by the end of the decade they were even lower than before, being then equivalent to between $54 and $65 per ton.[19] The costs of vessels of the two types of

[16] Lynch Report, p. 224.
[17] Lynch Report, p. 224.
[18] Lynch Report, p. 224.
[19] Dingley Report, p. 50; A.R.C.N., 1885, p. 33.

material were thus nearly the same, and keen competition consequently developed. In operation, however, many American owners were at a disadvantage because of the higher manning costs and higher damage claims incurred by their vessels.

The construction of deep-sea sailing ships in Great Britain consequently increased rapidly between 1850 and 1870. Although the proportion of iron tonnage in the total of all kinds built had been but 26 per cent in 1853, it reached 50 per cent in 1862 and 72 per cent in 1868. A considerable proportion of this output of iron vessels consisted of sailing ships. During the last-named year, there were built 162 such vessels, which averaged 813 tons in size, as well as 29 craft of composite construction, which averaged 700 tons.[20] Wooden construction was by then only employed in small craft for the coastwise trade and fishing.[21] Great difficulty in selling larger wooden ships, except at a ruinous loss, was then being encountered by their builders. Some large ships which had been built on speculation remained unsold for some time.[22] Iron vessels were by then receiving the more valuable and perishable cargoes. Shipowners, indeed, were very enthusiastic regarding the prospects of these vessels in the growing Californian grain, Australian wool, South American nitrate, Indian jute, and English and Australian coal trades, in which these vessels were being chiefly employed.

The tonnage of sailing vessels built in Great Britain consequently rose from an average of 152,000 net tons during the boom years 1847–1857 to 200,000 net tons during the years 1858–1869.[23] Although construction was afterward temporarily depressed by the alterations in the eastern trades caused by the opening of the Suez Canal and by the short grain crops in California in the years 1871–1873, the average output for the years 1870–1878 was 153,000 net tons.[24] The output of sailing ships was particularly high in the mid-'seventies, the peak of 245,357 net tons being reached in 1875. Nothing illustrates better the non-competitive relation between steam and sailing vessels at this time, for this was a period of slack times in the building of steam vessels. Because of the activity in the yards building iron sailing vessels, and because of purchases of wooden ships in the United

[20] Lynch Report, p. 218.
[21] Lynch Report, p. 218.
[22] Lynch Report, p. 224.
[23] A.R.C.N., 1901, pp. 474–476.
[24] A.R.C.N., 1901, p. 476.

States and Canada, the British sailing fleet employed in the overseas foreign trade rose from 2,143,234 net tons in 1850 to 2,804,610 net tons in 1860, and to an all-time high level of 3,646,150 net tons in 1868. After this a slow decline set in, and by 1878 the tonnage had fallen to 3,236,081 net tons.[25] Thus it may be seen that the development of the iron hull enabled British shipbuilders to undertake profitably the construction of large square-rigged ships for the competitive oceanic trades.

A comparison of shipbuilding activity in Great Britain and the United States is significant. The output of the American yards building wooden sailing ships, which were the only vessels which American owners could profitably use, fell severely after 1856 in comparison with that of the United Kingdom. During the boom years from 1847 to 1857 the United States had outbuilt the British Isles in sailing ships by 3,390,500 gross tons to about 1,757,000 gross tons.[26] By 1868, however, the British output of sailing vessels of all kinds considerably exceeded that of the United States, the figures for that year being about 266,000 gross tons and 143,000 gross tons respectively. The leadership of the British yards had, in fact, begun as early as 1859. During the depression from 1871 to 1873, however, American builders suffered less severely, the outputs in 1872, for example, being about 58,757 gross tons and 76,299 gross tons respectively. In the subsequent boom, from 1874 to 1878, British yards outbuilt American ones by a ratio of more than three to two, the tonnage built in the former during these five years being approximately 1,100,000 gross tons, and in the latter 754,000 gross tons. Of the American tonnage, however, but 425,131 gross tons consisted of deep-sea square-rigged vessels, namely ships, barks, and barkentines, the rest being schooners and small craft. It may be seen, therefore, that the localization of the industry of building square-rigged ships had, in fact, moved to the United Kingdom, where low costs of iron, increasing returns in shipbuilding, and ample facilities were available.

3

Another notable technical advance was made with the introduction of steel as a material for sailing-ship hulls in the early

[25] A.R.C.N., 1901, pp. 480-481.

[26] A.R.C.N., pp. 474-475, 581-582. The British figures, which are given in net tons, have been converted to gross tons by the addition of 8 per cent.

'eighties. Although this material had been used in the ship *Clytemnestra* as early as 1863 [27] and in the bark *Altcar*, 1283 tons, which was built at Liverpool by Jones, Quigg & Company in 1864,[28] its price was too high relative to that of iron to allow of much use until the development of the basic process of steel manufacturing in the late 'seventies. In 1882, however, four big steel sailing ships, the *Garfield*, *Pinmore*, *Helenslea*, and *Sierra Parima* came off the ways,[29] and thereafter few vessels were built of iron. Steel was advantageous as a material for shipbuilding because it was stronger and lighter than iron, and hence greater carrying capacity on a given gross tonnage was possible. It was also used in the masts, yards, and rigging, where strength and lightness were important; the first vessel to be so fitted probably was the *Seaforth*, which was built in 1863.[30] Most important was the fall in the prices of steel square-rigged vessels to much lower levels than had formerly prevailed — a fact which spelled disaster to the builders of wooden ships in North America. The price of ship steel in England fell from $100 per ton about 1871, when it was over twice as costly as iron,[31] to $80 per ton about 1873, and then to $20 per ton in the early 'eighties.[32] In sympathy, the prices of sailing ships fell by about 40 per cent, that is, from between $70 and $75 per gross ton, gold, in the early 'seventies to between $50 and $65 per gross ton in the early 'eighties, and to between $45 and $50 per ton in the 'nineties. The price of ordinary steam tramp ships likewise declined from a range of $85–$125 per gross ton in 1860 to one of $77–$105 in 1869, one of $50–$85 in 1877, one of $30–$60 in 1887, and one of $20–$50 in 1904.[33] Hence the competitive advantage of British shipowners and of others who bought British ships was greatly increased.

The construction of square-rigged ships in Great Britain was continued after 1880 at a lively clip for several decades. In 1879, as a result of short grain crops and temporary overbuilding, there

[27] Clapham, *Economic History of Modern Britain*, II, 56.

[28] Lubbock, *The Last of the Windjammers*, 2 vols. (1927), I, 257.

[29] Lubbock, *The Last of the Windjammers*, I, 257.

[30] A. H. Clark, pp. 322–323.

[31] J. B. Howell, "On Steel as Applied to Shipbuilding," *Trans. I.N.A.*, XII (1871), 16.

[32] Wells, p. 43.

[33] A. W. Kirkaldy, *British Shipping* (1919), Appendix XXII; Lynch Report, pp. 223–224; A.R.C.N., 1894, pp. xxiii–xxiv; A.R.C.N., 1901, pp. 23–24; R.M.M.C., I, 184.

was a general collapse of sailing-ship construction. Output in Great Britain soon revived, however, beginning in 1882. Indeed, during the twelve years from 1882 to 1893 it averaged 162,000 net tons a year, despite a recession during the years 1887 and 1888 — a level which was only slightly below that of the boom years of the 'seventies. In 1892 an all-time record output of 287,072 net tons came off the ways. To a large extent this construction was at the expense of that in the United States and Canada. In the former country, construction fell off badly, for builders were totally unable to equal foreign prices. In 1885, at the height of the boom of the 'eighties, British yards launched about 237,000 gross tons of sailing ships while those in the United States completed but 65,400 gross tons, of which but 15,900 gross tons consisted of deep-sea square-rigged craft.[34] In 1892, when the peak of this type of construction was reached in Great Britain, only eight full-rigged ships and barks were built in the United States, and, in fact, the last full-rigged ship, the *Aryan*, was built only two years later. After 1893, however, the construction of sailing ships in Great Britain rapidly declined because of the competition of bounty-fed French sailing ships and the inroads of steamships in the long-voyage trades. Indeed, during the ten-year period 1893–1902 the average output was but 73,500 net tons. At about the same time a substantial decline in the tonnage of British sailing craft employed in foreign trade began to develop, although in 1892, it still amounted to 2,388,800 net tons. Thus it may be seen that, contrary to common opinion, the construction of square-rigged vessels continued at an active pace for some time after 1880, but that American builders failed to take part in this activity to any substantial extent because of unfavorable cost conditions.

The majority of the British iron square-rigged ships were large full-ended freighters, which increased in size from about 1000 gross tons in the 'sixties to about 1500 gross tons in the 'seventies and to about 2500 gross tons in the 'eighties. A few were sharp-ended clippers, especially those constructed for the Australian wool trade, but the majority were intended to be economical freighters of moderate speed. During the 'sixties and 'seventies the three-masted ship rig with double topsails and top-gallant sails and metal spars and rigging was generally employed. In the

[34] Shipentines, ships, barks, and barkentines.

'eighties and 'nineties, however, the four-masted shipentine rig, which was more economical and suitable for the large, long hulls then being built, was widely used, having been introduced on the *Tweedsdale*, 1403 tons, in 1877.[35] Some four-masted ships were also built, beginning in 1875 with the *County of Peebles*, 1614 tons, but this rig, which was more costly to operate than that of the shipentine, was never popular, and not more than a hundred such ships came out.[36] At this time metal vessels began on the whole substantially to exceed wooden ones in size. Some of these metal vessels were fitted to carry passengers and were operated in packet lines to Australia and the East, the most famous being probably the Loch Line. The construction of these ships was, on the whole, a simple matter for the shipbuilders, many of whom had elaborate equipment and were engaged in the more costly and difficult work of constructing steamships and war vessels. Some yards specialized in this business, however, the most notable being Russell & Company at Greenock, which in the two years 1883 and 1884 alone built forty-one ships and barks.[37] To a large extent the designs became standardized during the late 'seventies and 'eighties, with the result that considerable economies were achieved through the building of several vessels to one set of plans. In this respect the builders of iron vessels had a considerable advantage over those constructing wooden ones. Thus from British yards there poured forth a huge fleet of big, stout, economical, sail-driven freighters.

4

The final development of the square-rigged ship was to a large degree carried on under the flag of the French Republic. Until 1881 the various owners of sailing ships, unlike those of steam vessels, competed in the international carrying trades practically without the aid of subsidies of any sort. In that year, however, the French government established a system of navigation and construction bounties which were both heavy and particularly favorable to owners operating steel-sailing ships in the long-voyage trades. The result was a substantial increase in this type of construction in France and a notable diminution in the number of vessels under other flags engaged in these trades.

[35] Lubbock, *The Last of the Windjammers*, I, 223–224.
[36] Lubbock, *The Last of the Windjammers*, I, 188–189.
[37] Lubbock, *The Last of the Windjammers*, I, 247.

The background of this episode is interesting. The industry of building steel ships in France operated at a substantial disadvantage in comparison with the English one owing to the distance of the yards from the centers of the iron and steel industry, which was in the northeast, the undeveloped state of this industry, the small-scale of shipbuilding operations, and the lack of experience on the part of the managements.[38] Consequently French shipbuilders were unable to equal the prices of the English yards.[39] The latter had been doing, in fact, a substantial export business in metal sailing and steam vessels for some time, not only to France, but also to Germany, Scandinavia, and other countries. The French shipbuilding industry consequently languished, especially after 1860 when the free purchase of English vessels became possible. But the French shipping industry, although considerably benefited by this action, was inefficient, troubled by high capital and labor costs, and unenterprising. Consequently it failed to make progress.

The government of the Republic therefore determined to pursue a bounty policy. In the Act of 1881 owners of vessels of French construction were entitled to a navigation bounty of 1.5 *fr.* (29 cents) for each gross ton per 1000 sea miles sailed, and owners of foreign-built vessels to one-half this amount. The rate diminished for each year of a vessel's life. Shipbuilders received a bounty of 60 *fr.* ($11.58) per gross ton on metal ships, but this was apparently without much influence on the result, for many vessels were purchased abroad. This law had some effect temporarily in increasing the amount of French square-rigged tonnage, but the bounties were, in general, insufficient to overcome the difficulties of French shipping, and the contracts were too short in length to encourage shipowners.[40]

The government was determined, however, to overcome all obstacles, and hence the rates were greatly increased in the law of 1893. The shipowners were then required to buy French-built vessels, but the construction bounty of 65 *fr.* ($12.55) per ton on metal sailing vessels easily offset any unfavorable differential on this account. Sailing ships of steel now received the huge sum of 1.7 *fr.* (32.81 cents) per gross ton for each 1000 miles sailed, the rate diminishing by 6 centimes (1.158 cents) per year. By accident or design this exceeded the rate of 1.10 *fr.* (21.23 cents)

[38] Lefol, p. 11. [39] Lefol, p. 15. [40] Charliat, pp. 174–175.

allowed to steam vessels. The result was that not only was a heavy investment made in French shipping, for with the aid of the bounty an elastic part of the supply curve of shipping enterprise was reached, but 70 per cent of the new construction consisted of sailing vessels.[41]

From the standpoint of the American shipping industry the most significant result was a further fall in freight rates in the grain and other long-voyage trades. This episode is, indeed, one of the best examples of the effective use of a navigation bounty to drive foreign shipping out of operation. The general navigation bounty was so large that according to the accounts of one French shipping firm operating seven large vessels the premiums were approximately equal to the freight income.[42] At such rates vessels could put to sea and cover direct operating costs without loading cargo. This measure was somewhat modified in 1902, the chief changes of importance being the limitation of the subsidized fleet to an additional 100,000 gross tons, and the addition of a requirement that cargoes be carried during a portion of each voyage. Under these acts, French shipyards built a large number of big vessels, chiefly four-masted shipentines, for the French shipping houses.[43] In 1900, for instance, there were built at Nantes, St. Nazaire, Havre, and Rouen thirty-nine such vessels totaling 91,346 gross tons, of which thirty-two were in excess of 2000 gross tons. The largest of these were the *Martha* and *Valentine*, which were of 3250 tons each.[44] The size of the French sailing marine consequently increased from 196,224 net tons in 1893 to 338,847 net tons in 1901 and to a peak of 487,458 net tons in 1906, after which a slow decline to 397,152 net tons in 1914 occurred.[45] The total bounties paid to French-built sailing ships rose from 327,000 *fr.* in 1893 to 7,108,000 *fr.* ($1,370,000) in 1900 — a relatively large sum. Thus when British and American sail shipping was declining that of France was beginning a spectacular rise.

French participation in the grain trade consequently rose nota-

[41] Meeker, p. 55.

[42] Meeker, p. 57; "Chronique," *Journal des Economistes*, Paris, XLVIII (1901), 314.

[43] Louis Lacroix, *Les Derniers Grands Voiliers, Histoire des Long-Courriers Nantais de 1893 à 1913* (1937)., *passim*.

[44] A.R.C.N., 1901, p. 137.

[45] A.R.C.N., 1901, p. 132; A.R.C.N., 1907, p. 93; A.R.C.N., 1914, p. 83.

bly. In the four years from 1881 to 1884 but 23 French ships had sailed out of a total of 1533 vessels.[46] By 1903, however, the French flag flew on 78 of the 230 square-rigged ships which loaded.[47] The French navigation bounty was therefore responsible for the rise of French tonnage. Although it is doubtful if France received any adequate recompense for the large sums expended, it must be acknowledged that the policy was successful in increasing the size of the French sailing fleet and in forcing out of the long-voyage trades the marginal vessels, which were chiefly American. This was the result desired by the French government. Since the bounty was general, and subsidized vessels were engaged in competition among themselves as well as with others, there is no reason to believe that the French shipping enterprises, as profit-making concerns, were conducted inefficiently, although the rationality of the entire policy may be questioned. The policy may, therefore, be called a success.

The competition of the vessels of the other maritime nations of Europe in the long-voyage trades frequented by American sailing ships was relatively unimportant. No substantial government aid was given to any of these fleets. Much of the tonnage of the Scandinavian countries consisted of second-hand American and Canadian wooden ships and British metal ones. Indeed, as British owners rapidly adopted steam propulsion for freighters, beginning in the 'nineties, they sold many of their vessels to Norwegian, Swedish and Danish concerns, which were still able to operate them successfully because of their low labor costs. German owners also purchased a number of these craft. With the development of the German iron and steel industry and the consequent renaissance of the shipbuilding industry during the 'eighties and 'nineties, however, a number of large steel vessels were built for the deep-sea trades in the Reich. German vessels, like the British and American, found difficulty in competing with the French, and consequently the German fleet was never very large. For instance, in 1903 there were but twenty-two German ships in the Pacific coast grain trade.[48] The big fleets in the trade were therefore the British, American, and French.

[46] W. W. Bates, *American Marine*, p. 241.
[47] Statement of G. F. Thorndike, shipping executive, R.M.M.C., II, 1033.
[48] Statement of G. F. Thorndike, R.M.M.C., II, 1033.

5

There was during this period one other important country where square-rigged ships were built at a lower cost than in the United States, namely Canada. In this case, however, the vessels were of wood like those of the United States and were likewise built under conditions of increasing cost. The Canadian timber situation was similar to that of the United States some thirty years earlier. At the great building centers on the St. Lawrence and the Bay of Fundy and along the Nova Scotian coast local supplies of timber remained adequate for some time. The shipbuilders there notably increased the quality of their vessels by the use of winter-cut spruce, care in the selection of timber, seasoning, and salting, and also rivaled the Maine builders in size and model. Both the French- and English-speaking workmen were less influenced than those of Maine by the rising wage rates caused by the industrial and agricultural expansion. The absence of duties on iron and other materials used in the shipyards also furthered the growth of the industry. Canadian shipbuilding consequently reached a peak of activity and perfection during the 'sixties and 'seventies when American yards were experiencing difficulties.

The ships of Canada of this period proved in general to be excellent vessels, in contrast with many of former times. The majority were two-decked medium clippers of between 1500 and 2500 gross tons. In model and appearance they closely resembled the ships built in Maine and Massachusetts and, in fact, some of the prominent builders, notably Lauchlan McKay and Henry Warner of McKay & Warner of Quebec,[49] had first achieved fame in the United States. The rig used was generally that of the three-masted skysail-yard ship, which was similar to that of American craft. Only two small shipentines, the *John M. Blaikie*, 1829 tons, and *Kings County*, 2240 tons, were constructed.[50] Canadian ships, however, were somewhat smaller than the largest American ones. In fact the largest ship built in Canada, the *William D. Lawrence*, measured only 2459 tons.[51] These ships were now generally built with spruce frames rather than with the

[49] Wallace, *In the Wake of the Wind Ships* (1927), p. 82.
[50] Wallace, *Wooden Ships and Iron Men*, pp. 298, 313.
[51] Wallace, *Wooden Ships and Iron Men*, p. 206.

hackmatack and hardwood ones formerly used. This type of construction increased the deadweight carrying capacity by 16 per cent or more, and in addition was some 5 per cent cheaper because of the great abundance and ubiquity of spruce.[52] When care was taken to cut the timber in winter, abundantly salt it, and provide as much ventilation as possible, these copper-fastened soft-wood ships sometimes proved to be serviceable for as many as sixteen or twenty years.[53] Their durability was usually somewhat less, however, than that of American vessels. In high-grade ships a considerable amount of white and live oak was used. These vessels were built under the careful supervision of the two leading classification societies, the British Lloyd's Register and the French Bureau Veritas. Considerable ingenuity, which included the use of iron knees, was employed in improving the manner of their construction. Some of these ships secured the highest ratings, namely twelve and fourteen years A1, at Lloyd's Register.[54] These ships were consequently strong competitors of the American square-rigged marine.

The principal advantage possessed by the Canadian yards lay in the comparatively low costs at which they could build these vessels during the three decades after 1860. Although there were wide variations among the yards, it may be estimated that the advantage of the Canadian yards compared with those of Maine was between 25 and 30 per cent during the 'seventies. In 1869, for instance, the prices of completely outfitted copper-fastened ships of oak and spruce were between $42 and $44 per gross ton, gold, at St. John, and ships of poorer construction were priced as low as $34 per gross ton,[55] whereas American ships were priced at between $50 and $60 per gross ton, gold. American shipowners who were taking shares in Canadian vessels reported that savings of between $15 and $20 per ton could be secured. Later, however, the prices of big Canadian grain ships rose somewhat. In 1869 ship carpenters in Canada were receiving between eight and nine shillings per day, which was considerably below the American figure. The expansion of Canadian shipbuilding, therefore,

[52] Statements of Lloyd's Surveyor and D. B. Warner, Consul at St. John, N. B., Lynch Report, pp. 228–229.

[53] Statements of Lloyd's Surveyor and D. B. Warner, Lynch Report, p. 229.

[54] Wallace, *Wooden Ships and Iron Men*, pp. 276, 309.

[55] Statement of D. B. Warner, Lynch Report, p. 228; see also statement of N. G. Hichborn, p. 19; and estimates of several Canadian firms, pp. 137–138.

was based on low costs, but it proved to be impossible for the builders to avoid disaster as timber prices rose at home and the prices of iron ships fell.

Canadian-built vessels thus played a large role in the long-voyage carrying business. Some were operated under the Canadian ensign, but the majority were still built on speculation for the British market, where they were sold to British firms for operation in the grain and other trades.[56] Indeed, during the 'sixties and 'seventies these sales were very brisk, for British buyers rapidly transferred their demand from the United States because of high prices there. Much of this business was centered at St. John and Quebec; for instance, seven of the ten full-rigged ships built at Quebec in 1872 were sold abroad.[57] The total tonnage sold abroad by the builders and owners of the Dominion, which is probably a good indicator of the business in new ships, shows that a substantial proportion of the new construction of all types passed to overseas owners, which were chiefly British, although sales were also made in France. For example, in 1876 the sales amounted to 64,134 net tons, or 39 per cent of the output, and were valued at $2,189,270.[58] Sales subsequently declined rapidly, however, as a result of the growing unwillingness of British owners to purchase wooden vessels. These vessels, which thus sailed under British and Canadian registers, comprised the third largest sailing-ship fleet in the grain trade prior to the 'nineties, as is shown by the fact that during the four years 1881–1884 of the 1533 ships leaving San Francisco for Europe, 761 were British iron vessels, 418 were American wooden ones, and 198 were British and Canadian wooden ones.[59] Since wooden shipbuilding in Great Britain had been relatively inactive for a quarter of a century, there is little doubt that Canada was the origin of most of the ships of the last group. These ships were also employed in the lumber, coal, guano, case oil, and general cargo trades. Thus Canadian builders were able to take full advantage of their temporarily favorable position.

During this period, the Canadian industry of building square-

[56] Wallace, *Wooden Ships and Iron Men*, pp. 262–263.

[57] Narcisse Rosa, *La Construction des Navires à Quebec et Ses Environs* (1897), p. 26; Wallace, *Wooden Ships and Iron Men*, pp. 263–269.

[58] Dominion of Canada, Department of Customs, *Shipping Report*, 1917, Sess. Paper no. 11a, 1918, p. 7.

[59] W. W. Bates, *American Marine*, p. 241.

rigged ships appears to have rivaled closely the American. Indeed, a marked shift in the localization of this shipbuilding industry northeastward along the Atlantic Coast toward lower timber and labor costs took place. F. W. Wallace's list for the years 1840–1894, which covers square-rigged vessels of 500 tons and over, shows an output of 3700 vessels — a figure which may be compared with that of 5530 ships and barks built in the United States.[60] An indication of the activity in Canada is also given by the number of large vessels built at Quebec, an important center for the export trade in sailing ships. Here during the years from 1860 to 1864 213 ships and barks were built,[61] compared with 489 in the entire United States. During the following five-year period the figures were 173 and 471 respectively. The year 1864, in which 43 ships and 18 barks besides some smaller craft were built, was particularly active and exceeded 1853, although in the United States this was a year of depression. After 1870 shipbuilding decayed at Quebec, however, because of the decline of the export business, but it prospered elsewhere, especially in Nova Scotia. The total output of all types of vessels, which consisted very largely of sailers, rose from about 100,000 gross tons in 1870 to about 203,000 gross tons in 1875,[62] which was the high point. In that year, it was approximately equal to the output of 207,000 gross tons of sailing vessels in the United States. Of the latter, however, only 114,000 gross tons consisted of ships and barks.

The active construction of wooden square-rigged vessels was continued no longer in Canada than in the United States. By 1885 it had become impossible for the builders there who had no protected market to compete with those building steel sailing ships. Output in that year was but 62,000 gross tons, and thereafter it rapidly declined. In the early 'nineties extensive sales of Canadian wooden shipping, most of it second hand, to Scandinavian and other foreign owners occurred. The last big wooden ships were built at Quebec in 1887 and on the seaboard in 1893.[63]

[60] Wallace, *Record of Canadian Shipping* (1929), p. v.

[61] Figures compiled from Rosa, Statistical Tables. The number of ships and barks built at Quebec during the period 1870–1874 was ninety-eight, and during the period 1875–1879 was seventy-four.

[62] Canada, *Shipping Report*, 1917, p. 7. The net tonnage of the Canadian vessels was converted to gross tonnage by the addition of 8 per cent.

[63] Wallace, *Wooden Ships and Iron Men*, pp. 311–320.

Indeed, Canadian owners, who were not limited to domestic vessels as were those in the United States, began in 1884 to purchase steel ships and shipentines from the Clyde builders, the first purchase being the Dumbarton-built *Howard D. Troop*.[64] About eighteen of these vessels were acquired,[65] but this promising reconstruction of the Canadian marine was checked by the rise of the subsidized French fleet and by the general decline of sailing-ship navigation. The experience of Canada indicates that the continued construction of wooden ships was economically unsound after the development of steel hulls, and that the natural solution was the purchase of metal vessels in the cheapest market. Had operating costs been lower and capital more plentiful it is probable that Canadian shipping would have grown on this basis. American owners, however, had no such alternative.

6

Since relatively low prices prevailed for excellent square-rigged ships in Canada and Great Britain throughout the entire period from the Civil War to 1914, and in France and Germany during the latter part, it was essential that American shipowners secure suitable vessels at comparable figures if American participation in the deep-sea carrying trades was to continue. It might be expected, therefore, that some substantial effort to develop the construction of metal sailing ships in the United States would have been made, but such was not the case, mainly because of the backwardness of the builders of iron ships, the relatively high wage rates paid to labor in the yards, and the high cost of iron and steel. This latter difficulty was partly due to the tariff, partly to the unfavorable localization of the iron and steel industry and mines, and partly to the monopolistic practices of the steel companies. Consequently, only a handful of metal square-rigged vessels were built, mainly as experiments, and these exerted little influence on the course of events. The builders of wooden ships, indeed, until the World War could turn out sailing ships of fair quality at a much lower price than those constructing metal vessels. Hence the former, although suffering from increasing real costs, faced practically no competition from the latter, and there-

[64] Wallace, *In the Wake of the Wind Ships*, p. 170.

[65] Wallace, *Record of Canadian Shipping*, pp. 301–302; Lubbock, *The Last of the Windjammers*, II, 136–138, 160–162.

fore remained the primary source of the vessels used in the sailing-ship trades, and in fact, in American foreign commerce as a whole. The American square-rigged marine, and likewise the foreign-trade fleet, therefore rapidly declined with the weakening of the position of the wooden sailing ship.

The entire episode of the construction of iron ships in the United States illustrates the difficulties which were encountered on a greater scale in the building of steam vessels. The shipyards, unlike those building wooden vessels, remained until well toward the close of the nineteenth century inferior to those of Europe in quantity of investment, machinery and tools, and technical leadership. The first builders were, for the most part, boiler-makers, and had had little contact with the shipping industry. Experimental sailing ships were, however, built on the Delaware, the center of iron ship construction, and at Boston, the first being the 216-ton schooner *Mahlon Betts*, which was constructed by Betts, Pusey & Jones at Wilmington in 1855.[66] An extraordinary vessel, the first of large size to be built in the United States, and one which perhaps indicates the state of the shipbuilding industry, was the auxiliary screw full-rigged ship *Voyageur de la Mer*, 1300 tons and 800 horsepower, which was built at East Boston by Holden & Gallagher in the years 1856–1857 and was sold to the Pasha of Egypt. This vessel, which was modeled by the celebrated clipper-ship designer Samuel Pook, had a double frame of iron and wood on which were fastened 3000 small plates, the whole being a most expensive piece of construction.[67] Probably the most successful of these early vessels, however, was the brig *Nankin*, 300 tons, which was built by Otis Tufts at East Boston in 1858 to the order of R. B. Forbes, one of the largest Boston shipowners and a China merchant, who experimented with all kinds of improvements in vessels. Forbes was much pleased with the performance of this vessel in the China trade and particularly with the manner in which she survived a stranding in Yokohama during a typhoon in 1859, but her cost was evidently excessive, for the order was not repeated.[68] Thereafter few iron sailers were laid down, the only ones of importance being the bulk-molasses carrier *Novelty*, 359 tons, which was built at the Atlantic Works at East

[66] W. M. Lytle, "Iron Construction in the United States," A.R.C.N., 1899, Appendix L, 217.

[67] *R.B.B.T.*, 1857, pp. 86–90.

[68] French, pp. 44–46.

Boston for Nash, Spaulding & Company of New York in 1869,[69] and the bark *Iron Age*, 680 tons, which was built in the same year by Harlan & Hollingsworth of Wilmington for Tupper & Beattie of New York.[70] None of these vessels engaged in the great deep-sea trades which were then interesting shipowners, and, indeed, most of the shipping firms engaged in them subsequently gave up all consideration of iron ships until the mid-'eighties.

Only three large square-rigged ships of iron were built in the United States, because of the high cost of construction. The *Iron Age* had cost the discouraging sum of $110 per gross ton, complete with outfit, and $85 per ton for hull and spars alone, and estimates of prices ranged as high as $135 per gross ton.[71] The three ships which were built, all of which measured about 2000 gross tons, were the *Tillie E. Starbuck*, built at Chester in 1883 by John Roach, who was perhaps the leading builder of iron ships, and the *T. F. Oakes* and *Clarence S. Bement*, which were also built on the Delaware by the American Shipbuilding Company in 1883 and 1884 respectively.[72] These were not, however, a financial success.

The building of metal sailing ships was thus a business of no importance in the United States. The first sustained and successful effort at this type of construction was, curiously enough, made by the noted firm of E. & A. Sewall of Bath, which, after completing the big *Roanoke*, determined to build steel sailing ships by using English steel, on which a drawback of the duty could then be secured. The first of these vessels, launched in 1894, was the four-masted 3005-ton shipentine *Dirigo*, the steel of which came from Motherwell, where it was cut, punched, and shaped, and the design and construction of which were supervised by Englishmen.[73] The ship was not an entirely satisfactory investment, however, for two reasons: she cost more than Clyde-built vessels because of the expense of shipping the material and the higher wage rates paid to the shipwrights, and under the provisions of the tariff acts she could not be employed in the coastwise trade for more than two months unless the owners paid the full amount of the duty.[74] In the case of sailing ships, the passages of which

[69] Nimmo Report, p. 23.

[70] Nimmo Report, p. 23; Lytle, p. 221.

[71] Nimmo Report, pp. 19–20.

[72] Lubbock, *The Down-Easters*, pp. 144–145, 148–149, 161.

[73] Lubbock, *The Down-Easters*, pp. 192–193.

[74] Statement of W. D. Sewall, R.M.M.C., I, 104, 110.

were uncertain, this provision caused great anxiety. Hence no more steel vessels were built until after the annexation of Hawaii, which provided a booming protected sugar trade. The Sewalls then built between 1899 and 1901 for their own account the shipentines *Erskine M. Phelps*, *Arthur Sewall*, *Edward Sewall*, and *William P. Frye*, and, in addition, the *Kauilani*, a sharp ship, *Astral*, *Acme*, and *Atlas* for others. The last three were for the Standard Oil Company. The *Atlas*, which measured 3381 tons, was the largest steel square-rigged ship built in the United States. In all of these vessels domestic steel was used, thus allowing unrestricted operation within the navigation monopoly.

By this time the cost of building steel vessels had fallen until it was closer to that of wooden ones than formerly. For instance, the big Sewall ships of 1900 cost about $67 per gross ton, whereas the last wooden ships from the same yard had cost about $53 per gross ton. The cost of building similar vessels on the Clyde was, however, from 33 to 40 per cent less.[75] The venture can therefore scarcely be called a success, for although some vessels were supplied which, considering the superiority of steel, were probably economically preferable to wooden ones for use in the long-voyage protected trades, nevertheless the operation of such craft in the unprotected trades was financially impossible. The business of building steel ships in this case did not prove to be an infant industry to any significant degree, and the protection accorded it therefore had the effect of strangling the shipping industry and of perpetuating wooden shipping in the American marine long after it became obsolete abroad.

7

The unfavorable situation of the builders of both wooden and iron square-rigged vessels put serious pressure on the shipowners, which culminated in a wholesale collapse beginning in 1878. Since, in general, chartered vessels sailed fully laden and the freight rates were adjusted to the state of demand and supply, the level of these rates, and especially of those in the grain trade, was the primary factor determining earnings in the deep-sea shipping industry as a whole. Only if the earnings failed to cover the prime costs of operation, or if it seemed desirable to speculate on a rise in rates, was tonnage withheld. The general level of these rates

[75] Statement of W. D. Sewall, R.M.M.C., I, 107.

depended, on one hand, on the course of industrial and agricultural production and trade, and, on the other, on the speed with which the supply of vessels was adjusted to the demand. There was a strong tendency for the rate level to fall to a normal position, which was determined by the total costs of service of the lowest-cost fleet, provided, of course, that there was considerable elasticity of supply, as was the case in Great Britain. This, in fact, was the course of events following the Civil War. The American fleet, which was the principal marginal one, was consequently forced out of business, although the process was slow and tedious.

The freight rate on grain moving from the Pacific Coast was easily the most important of the many rates. It may be estimated that in general a rate of about 75 shillings per long ton was adequate to remunerate fully the owners of American wooden vessels, and that one of 85 shillings or more was sufficient to induce a strong expansion. On the other hand, at 40 shillings or below some vessels were likely to be laid up. There is evidence that rates were unprofitable in the seasons between 1870 and 1872, but in the seasons 1872–73 and 1873–74 high levels were reached as a result of a shortage of tonnage to move the increasingly large crops. The average rates during the former stood at 81*s.* 3*d.*, and during the latter at 74*s.* 6*d.*[76] The result was that the American shipping industry experienced its second large post-war boom. The average number of large square-rigged ships built annually, which was 91 during the years from 1865 to 1870, and 28 during the period from 1871 to 1873, rose to 83 during the five active years from 1874 to 1878, the peak being reached in 1875, when 114 ships totaling 113,820 gross tons were built.[77] The fleets of many owners were substantially increased at this time, and many vessels were constructed on speculation. Although the rate fell to 55*s.* 4*d.* per long ton in the season of 1874–75, and to 52*s.* 7*d.* by the season 1876–77, neither builders nor owners apparently saw little cause for concern.

By the crop year 1877–78, however, the trade was definitely over-tonnaged as the result of a rapid rate of construction in Great Britain and the United States, and the average freight rate conse-

[76] R.I.C., 1885, p. 322.
[77] R.C.N.T. for the years named. These figures cover shipentines, ships, barks, and barkentines built on the seaboard only.

quently fell to 44*s*.7*d*., and then in the next season to 43*s*.7*d*.[78] This decline produced a crisis, and many vessels were laid up.[79] Although the rate rose temporarily to 66*s*.9*d*. in the season 1880–81 because of a bumper crop and a scarcity of vessels, the trend continued sharply downward as new low-priced steel tonnage flowed into the trade. The average rate for wooden vessels consequently sank to 43*s*.6*d*. in 1882–83 and 25*s*.8*d*. in 1883–84, and it remained in the vicinity of 28*s*. until the end of the decade.[80] By 1903, when French tonnage was a factor, it was but 10*s*.[81] Sailing-ship rates in other trades fell in sympathy as owners sought alternative employments. That for wheat from New York to Liverpool was in 1882 but 39 per cent of that of 1873, and sailers were practically eliminated from the trade.[82] The output of big square-riggers consequently dropped from 81 in 1878 to 37 in 1879, and to an average of 29 during the six years 1879–1884. After this the disintegration of the industry occurred as output fell to 8 in 1886, 4 in 1888, and 1, a small barkentine, in 1889.[83] The crisis caused by the falling freight rates consequently came between 1878 and 1889.

American wooden ships suffered also from a considerable discrimination in freight rates in favor of iron vessels, which were of course chiefly British, because of differences in the insurance rates on cargo carried in the two types of vessel. This differential was substantial, ranging between 8 and 15 per cent of the wooden ships' rates depending on the state of supply and demand for iron tonnage and the quality of the wooden ships being offered. In general, the wooden ships were the marginal vessels, and if the supply of iron and steel tonnage was ample wooden ships might consequently have to make large reductions or else remain idle. For instance, in the season 1888–89 the average rate received by iron ships was 32*s*.7*d*., while that secured by wooden ships was but 28*s*.3*d*. The insurance rates on West Coast grain cargoes, which were largely determined by the classifications assigned by Lloyd's Register, were at this time 2 per cent in iron or steel vessels and 2¼ per cent in wood. This rate differential was said by W. W. Bates, at one time Commissioner of Navigation, to be

[78] R.I.C., 1885, p. 322.

[79] R.I.C., 1885, pp. 304–305.

[80] S. G. Brock, "The Commercial, Industrial and other Interests of the Western States," R.I.C., 1890, p. 353.

[81] R.M.M.C., I, 116.

[82] R.C.N.T., 1883, p. lxxi.

[83] R.C.N.T., for the years named.

due to a policy of arbitrary discrimination practiced by Lloyd's Register against American shipping. The Register was accused of not inspecting vessels on the stocks and of not giving American ships a class commensurate with their quality.[84] In this accusation he was supported by J. W. Griffiths and others interested in wooden vessels.[85] To a considerable degree, however, this evidence comes from prejudiced sources. Although Bates presented elaborate tables to prove his contention, his views were generally contradicted by shipowners and builders.[86] It was pointed out that, although wooden vessels when new and properly maintained delivered cargoes in good condition, yet leakage was difficult to prevent as they grew older. Furthermore, American owners had the opportunity to have their vessels classed by the French Bureau Veritas or other societies. It seems probable, therefore, that any discrimination not justified by losses was small, probably unintentional, and in no case a vital factor in the situation.

8

In other respects the American wooden ships of this period performed excellently. In speed they were nearly the equal of the clipper ships of the 'fifties, and in addition they matched that of the English iron fleet, for which fouling was a serious problem. On the run from New York to San Francisco, on which the celebrated *Flying Cloud* had hung up a record passage of 89 days and on which 100 days had been a good passage, the new big ships took regularly from 100 to 140 days. For instance, two big ships designed by John MacDonald, the *A. G. Ropes* and *Henry B. Hyde*, had passages, respectively, of 104, 107, and 110 days, and of 105, 108, 108, and 112 days. Averages are even more indicative, those for a few of the ships being as follows: *A. J. Fuller*, ten voyages, 116 days; *Alameda*, eight voyages, 134 days; *Seminole*,

[84] W. W. Bates, *American Marine*, chaps. xiv–xix; also "The Comparative Performance of American and Foreign Freighting Ships — Our Superiority," *Trans. S.N.A. & M.E.*, vol. I (1893).

[85] Statement of J. W. Griffiths, *Report of a Special Committee of the Boston Board of Trade on American Shipping Interests* (1871), pp. 1–2; statement of N. G. Hichborn, President, Maine Shipowners' Association, Lynch Report, p. 16; Nimmo Report, p. 26; *R.B.B.T.*, 1858, pp. 192–194.

[86] G. W. Dickie, a naval architect, "Some Obstacles to Ship Building and Owning in this Country," *Trans. S.N.A. & M.E.*, II (1894), 37; T. Nickerson, shipowner, Lynch Report, p. 115; J. S. Williams, former packet-ship operator, Lynch Report, p. 32; R. Chilcott, R.M.M.C., I, 1023–1024.

twenty voyages, 126 days; *I. F. Chapman*, thirteen voyages, 139 days; *America*, five voyages, 121 days; *Alfred D. Snow*, eight voyages, 128 days; *Shenandoah*, four voyages, 133 days; *Susquehanna*, seven voyages, 129 days; *Challenger*, six voyages, 130 days.[87] On the run from San Francisco to Queenstown or the Channel Bates shows that of the big fleets of 1881–1884 the 418 American wooden ships came first with an average of 125.5 days, the 761 British iron ships second with an average of 130.7 days, and the 198 British wooden ships, third with one of 131.8 days.[88] The fleets of France, Germany, Italy, Holland, Sweden, Norway and other nations, which fleets were relatively small, ranged on the whole considerably above these figures. The fastest passage by an American ship, which was made by the *Henry B. Hyde*, was 96 days to Liverpool, or the equivalent of 95 days to Queenstown.[89] The fastest run by an English iron vessel is said to have been 91 days.[90] Thus in speed wooden sailing ships performed remarkably well.

In strength and durability there was a wide variation because of differences in construction and upkeep among vessels, but most of the ships in the Cape Horn trades probably were serviceable on these routes for ten to fourteen years,[91] after which they might be navigated in the coal and lumber trades for some time longer. The surveyor of the French Bureau Veritas estimated in 1869 that the depreciation rate on these ships was about 7 per cent.[92] Some vessels remained in service for twenty years or more, but others, poorly seasoned and employed extensively in the tropics, decayed in about five years.[93] The general length of life was considerably less than it had been earlier in the century because the increased size and power imposed greater strains on the hulls and the materials were frequently inferior. At the root of the problem was the fact that the hull of a 1000-ton vessel was composed of some 1600 pieces of wood, many of which were short,

[87] Matthews, *American Sailing Ships*, vols. I, II. This work contains valuable histories of each of these ships.

[88] W. W. Bates, *American Marine*, p. 241. Passages to other ports were adjusted by Bates so as to be approximately equivalent to that to Queenstown.

[89] Matthews, *American Merchant Ships*, I, 156.

[90] W. W. Bates, *American Marine*, p. 249.

[91] Nimmo Report, p. 17; statement of E. H. Derby of Boston, an owner of sailing ships, Lynch Report, p. 102.

[92] Statement of Captain Samuel Harding, Nimmo Report, p. 51.

[93] Statement of R. B. Forbes, a Boston shipowner, *R.B.B.T.*, 1858, p. 93.

and these could not be rigidly and strongly fastened, especially at the butts of the planking where strength was necessary to prevent the bending of the hull along its length. Consequently hogging, sagging and general loosening occurred.[94] In general it proved impossible to increase the strength of the fastenings proportionately to the increase in the strains produced in the larger vessels.[95] Most wooden ships changed their form somewhat during their careers,[96] and some even became hogged while lying in the mud at the fitting-out dock, a fact which caused master carpenters to lay their keels with a slight rocker to them.[97] Wooden sailing ships, especially those regularly exposed to Cape Horn weather, therefore tended to become loose, generally after about five years, and this looseness tended to increase with decay and the working of the hull, with the result that the leakage increased. At times some ships were actually endangered by the springing of planks or other structural failures. A large number of American wooden ships were lost because of such weaknesses. Furthermore, wooden sailing ships were rarely fitted with water-tight bulkheads because of their weight and the expense of keeping them tight.[98] Hence there were serious structural difficulties to be found in the operation of large wooden ships.

In contrast, iron and steel hulls were in general probably nearly twice as durable, since they were subject neither to dry rot nor to serious loosening in the fastenings. Consequently their depreciation and repair costs were much less than those of wooden vessels. The only serious weakness was in the metal masts, which at first frequently buckled, whereas the pine ones of the American ships, though heavier, stood sturdily. British iron ships, however, were in general given too little freeboard and were loaded too heavily, with the result that losses due to heavy seas sweeping the decks, stove hatches, and injuries to spars and rigging were high.[99] On the other hand, they normally were fitted with bulkheads.

[94] T. J. Ditchburn, a leading English builder of wooden ships, in general discussion, *Trans. I.N.A.*, v (1864), 312; Lamport, "On Wood and Iron Ships, and the Advantages of the Combined System of Wood and Iron in Shipbuilding," *Trans. I.N.A.*, v (1864), 293–294.

[95] Grantham, "The Strength of Iron Ships," *Trans. I.N.A.*, I (1860), 62.

[96] Nimmo Report, p. 17.

[97] McKay, *The Practical Shipbuilder*, p. 48.

[98] Statement of R. B. Forbes, *R.B.B.T.*, 1858, p. 93.

[99] Lubbock, *The Last of the Windjammers*, *passim*; W. W. Bates, *American Marine*, pp. 242, 252–253.

Hence, although relatively new well-built wooden ships were undoubtedly as sound as iron ones and delivered their cargoes in as good condition,[100] the iron ships in the long run generally proved to be superior carriers. Wooden ships eighteen to twenty years old were generally recognized as useless in the grain and other perishable-cargo trades, and were relegated to the carrying of coal and lumber.[101] Even those but eight years old often had difficulty in securing employment in the better trades. The contention that wooden ships were economically superior to iron ones cannot, therefore, be sustained.

9

The protection accorded the shipbuilders under the registry law thus forced the American owners of square-rigged shipping to purchase vessels which were both more expensive to build and inferior in quality to those of their chief foreign competitors — a circumstance that was largely responsible for the disappearance of American shipping of this type. The crisis began about 1878, and soon brought shipbuilding to a halt all along the coast from New York to Eastport. Although some yards turned to the construction of schooners for the coastwise trade, financial difficulties overwhelmed many builders, especially those who had built vessels on speculation. In some cases, indeed, the entire industry in a town collapsed, with resulting great hardship on labor and the town economy in general. The failure of many shipping houses and the curtailment of others brought ruin to many builders, and frequently wiped out creditors. In over one-half of the districts the construction of full-rigged ships practically ceased. In comparison with output during the last half of the 'seventies, that of the last half of the 'eighties was down to 9 per cent in the case

[100] A.R.C.N., 1885, p. 116. The following table indicates the performance of forty U. S. wooden and sixty British iron ships on the San Francisco–Liverpool run in 1884:

Damage in Bags	*No. of U.S. Ships*	*No. of Br. Ships*
0	21	31
1–100	8	7
100–500	5	6
500–1000	4	5
over 1000	2	11

[101] Statement of W. G. Tibbetts, General Manager, Pacific Shipping Co., R.M. M.C., II, 1295; statement of Ambrose Snow, owner of wooden sailing ships, Lynch Report, p. 4.

of large square-rigged vessels, to 40 per cent in that of all sailing craft, and, so great was the importance of the industry of building wooden sailing ships, to 77 per cent in that of vessels of all types. This crisis in shipbuilding in the United States is summarized in the accompanying table:

GROSS TONNAGE OF VARIOUS TYPES OF VESSELS BUILT IN THE UNITED STATES[102]

Year	*Large square-rigged vessels*	*All sailing vessels*	*Iron and steel vessels*	*All vessels*
1870–74	223,680	680,755	69,593	1,551,203
1875–79	401,065	604,820	97,873	1,106,351
1880–84	164,907	516,731	170,348	1,211,083
1885–89	35,362	240,393	183,522	854,179

The careful tour which Henry Hall of the Census Bureau made of the shipbuilding towns in the early 'eighties showed a serious condition.[103] In eastern Maine the industry was badly decayed, there being four large yards at Machias which had been idle since 1876, no building at Cutler, Harrington, Ellsworth, or Blue Hill, which formerly had had prosperous yards, and only minor activity at Millbridge.[104] Coming into the Penobscot region he found a little construction and that of poor quality at Bucksport;[105] no activity at Castine or at Searsport, where an excellent yard had been sold at two-thirds of its cost; only a little construction up the Penobscot River, on which the last large square-rigged vessel was to be built in 1890;[106] no construction at Belfast, where square-rigged ships had not been built for five years; and only schooners building at Camden. There were large square-rigged ships under construction at Thomaston in the yards of Edward O'Brien and Samuel Watts, but activity was soon to cease in 1883 with the launching of the *R. D. Rice*, 2247 tons, by Watts.[107] Henceforth only great schooners were to be built there. Waldoboro was depressed and gloomy,[108] and the last full-rigged ship, the *George Curtis*, 1745 tons, was to be built by A. R. Reed in

[102] Compiled from R.C.N.T. for the years named.
[103] Hall Report, pp. 96–130.
[104] Hall Report, pp. 96–97.
[105] Hall Report, p. 97.
[106] G. S. Wasson and L. Colcord, *Old Sailing Ship Days on the Penobscot* (1932), Appendix.
[107] Lubbock, *The Down-Easters*, p. 147.
[108] Hall Report, p. 100.

1884.[109] At the formerly active centers of Damariscotta, Newcastle, and Wiscasset, business was at a standstill, the builders and owners had retired, and depopulation was under way.[110] At Boothbay the business had been dead for some time. Along the Kennebec, however, there was considerable activity, there being eleven busy yards at Bath and others elsewhere. E. & A. Sewall, the leading firm, were to build nine big wooden grain ships after the crash,[111] and the other firms were also to contribute several vessels. Nevertheless, the district was greatly depressed, so much so that the Sewall ship *Solitaire* was so named because when launched she was the only full-rigged vessel under construction in the port — a situation unprecedented for a century past.[112] In 1884 the firm of Goss, Sawyer & Packard was to fail,[113] and T. J. Southard at Richmond was soon to close his yard after completing the *Commodore T. H. Allen*.[114] The construction of wooden square-rigged ships was to cease with the completion of the *Roanoke* at the Sewall yard in 1892 and of the 1939-ton *Aryan* by C. V. Minott down the stream at Phippsburg in 1893, the latter being the last of the wooden, full-rigged, grain ships to be built in the East.[115]

Elsewhere the industry was practically dead. At Freeport, Brunswick, and Yarmouth the number of yards was greatly reduced, and these were inactive.[116] Kennebunkport, which was suffering from the collapse of N. L. Thompson's big yard, launched its last full-rigged ship, the 1925-ton *Reuce*, in 1881.[117] At Portsmouth, the launching of the last ship, the *Paul Jones*, which was completed by William Fernald in 1878, practically rang down the curtain on the industry there.[118] There was no ship construction of importance at Newburyport, Salem, Boston, Medford, Hanover, Scituate, and Duxbury, and along the southern New England coast at New Bedford, Providence, Mystic, Stonington,

[109] Miller, pp. 206–207.
[110] Hall Report, p. 100.
[111] These were the *Solitaire*, *Thomas M. Reed*, *Iroquois*, *Henry Villard*, *W. F. Babcock*, *Rappahannock*, *Shenandoah*, *Susquehanna*, and *Roanoke*.
[112] Matthews, *American Merchant Ships*, I, 297.
[113] Matthews, *American Merchant Ships*, I, 47.
[114] Lubbock, *The Down–Easters*, p. 151.
[115] Matthews, *American Merchant Ships*, II, 24.
[116] Hall Report, p. 104.
[117] Bryant.
[118] Portsmouth Customs House, Register Books.

New London, Bridgeport and Fairfield.[119] In all of these towns the yards were idle and the men were moving away. At New York and Boston there was considerable repair work, but the amount was much less than formerly because foreign shipowners preferred to do refitting abroad, where labor was less expensive.[120] Thus we get from Hall a picture of general decay.

Labor, as always in a decadent industry, suffered severely under these conditions, for unemployment was serious and there was considerable pressure on wage rates. In general labor was depressed and restive. Younger men turned if possible to industry, chiefly the cotton mills, or to agriculture, or migrated to more prosperous regions, thus causing depopulation and filling the shipyards with old men. Wage rates fell by 25 per cent or more in most cases, and sometimes men were hired on a share basis. Several strikes during the early 'eighties were broken by the importation of workmen from Canada, where conditions were even worse. Thus we see that economic movement was forced on the maritime section of the population by highly adverse conditions, and not, as is sometimes stated, directly by the superior opportunities elsewhere. Only intense pressure could overcome the natural immobility of labor and enterprise engaged in this business.

10

The shipowners were under similar pressure after 1878. In addition to the competitive disadvantage under which they operated because of the registry law, they felt the influence of an unfavorable operating differential of considerable amount. This was due primarily to the higher costs of manning in comparison with European and Canadian vessels, and, secondly, to such matters as admeasurement rules, taxes, consular fees, damage claims, duties on stores, repairs, and general efficiency.

The labor conditions on American square-rigged ships following the Civil War, and indeed on those of all flags, were extremely unsatisfactory. The former situation — in which, as a result of low vessel costs, a relatively high level of vessel efficiency, and technical leadership, it had been possible to pay wages comparable to those paid ashore and to provide relatively attractive working conditions — had gone, and instead a grinding system of

[119] Hall Report, pp. 108–114.

[120] Hall Report, p. 118.

exploitation, directly by the shipowners and indirectly by the shippers, was developed. It became, in fact, almost impossible for an American ship sailing on a foreign voyage to complete her complement by hoisting a sign as formerly.[121] Ship captains became dependent on the boarding-house masters, who were the operators of numerous low resorts in the principal seaports, and who for the sake of the month's advance wages normally paid them, not by the ship but by their victims, agreed to get the requisite number of men drunk, the articles signed, and the men aboard just before sailing. It was then up to the mates to get the men to work, establish discipline, and make sailors of the "shanghaied" landlubbers, a task which was usually accomplished with the aid of heavy-booted toes, fists, and brass kunckles. Manhandling ability, indeed, soon became a more valuable quality in an officer than seamanship. The men so signed usually proved to be of all nationalities, frequently understood English poorly or not at all, and physically and mentally were of an inferior type. Since economy was essential the big grain ships so supplied often went to sea short-handed, with the result that brutal man-driving was employed in order to make fast passages. Native-born Americans naturally refused to serve voluntarily on such vessels, and the situation tended to become worse. These methods of "impressment" and exploitation, which tended to become common in the latter days of sail, considerably lowered the general efficiency of American sailing ships.[122]

It also became difficult to secure officers of ability commensurate with that formerly secured, for the pay was low, the future uncertain, and the commercial opportunities which formerly were important were largely eliminated.[123] Hence Americans tended to leave this profession as well, few midshipmen were taken, and naturalized foreigners were widely used.[124] Owners even pressed for a relaxation of the law in order to secure the services of foreign mates.[125] This situation was of course only another indication of pressure.

[121] John Codman, *A Letter to the Hon. Charles Sumner on the Condition and Requirements of the American Merchant Marine* (1860), pp. 6–7.

[122] Codman, *Letter*, pp. 9–10.

[123] Statement of W. D. Sewall of E. & A. Sewall Co., R.M.M.C., I, 110.

[124] Statement of W. D. Sewall, R.M.M.C., I, 111.

[125] By an act of 1877, vessels carrying one or more foreign officers were taxed fifty cents per gross ton on each entry from a foreign port; see 19 U.S. Stat. 250.

The comparative costs of manning American and foreign vessels depended chiefly on the demand for and supply of foreign and American sailors and shanghaiable persons in the various ports, the degree of exploitation in which various masters could and would take part, the number of men and officers carried, and the ease and costs of discharge abroad. As has already been indicated, seamen's contracts, which were made for a round voyage, were to a considerable degree involuntary so far as the men were concerned, and the bargaining power of labor was thus low. Consequently customary rates of pay became established, and these remained substantially unchanged during the last half-century of sailing-ship operation, although on occasion the crimps and shipmasters conspired to reduce them. In general the rates of pay of both the officers and men depended on the size of the ship, the length of the voyage, the port of departure, and the port at which the crew was paid off. Of crucial importance was the provision in the law that seamen were to be signed for a round voyage to a foreign port. Crews could be discharged only in an American port. Discharge abroad could only be accomplished by the payment of three months' wages. Consequently it was necessary to pay rates roughly commensurate with those prevailing in shore establishments and with the cost of living in American ports in order to secure both native and foreign-born men, although this necessity was sometimes obviated by shanghaiing. Likewise foreign ships paid rates commensurate with their national wage and cost levels. American owners complained bitterly about the requirements of the labor contract, claiming that but for the round-voyage and discharge provisions they could secure good British, German, or Scandinavian crews abroad at foreign rates. They argued, indeed with some justice, that they often secured the riff-raff of the foreign labor supply, although they paid higher wages.

As a result, altogether too many shipmasters in the latter days adopted the policy of "hazing" and overworking their men in order to cause them to desert and abandon their pay in a foreign port, where lower-priced labor could then be signed. Brutal treatment designed to accomplish this end was summarized in the

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In 1884 an absolute prohibition against the employment of foreign officers, except in cases of emergency, was enacted. See 23 U.S. Stat. 53.

Red Record, a booklet published by labor on the West Coast, which presented hundreds of authenticated cases. So serious, in fact, were labor conditions on American deep-water ships that few foreign sailors willingly took service on them, despite the higher rates offered. Furthermore, since there were no manning regulations, many American ships went to sea extremely short-handed. In addition, many of the men put on board by the crimps as able seamen usually turned out to be landsmen, with the result that even the vaunted seamanship and iron discipline of the officers could not create efficiency. Thus the gap between the owners and officers on one hand, and the polyglot crew in the cramped, damp forecastle on the other, became immense. It must be recognized, however, that except for a few years in the mid-'seventies, sailing-ship operation under the American flag was not a profitable business, and that these measures merely kept a dying business alive for a few additional years.

II

One of the most serious weaknesses of American shipping policy at this time was the failure to regulate properly labor conditions on the deep-water ships. At the root of the problem was the advance or allotment system under which the crimps and boarding-house masters secured a fee of 25 per cent or more of a man's wages for placing him on board ship. These advances were normally paid on all voyages from American ports, and ranged as high as $40 per man on that from the Pacific Coast ports to Europe.[126] This ample charge might be paid by the owners, master, or seaman, but in general the latter paid the entire amount. Hence it became, in effect, a tax on wages from which sailors on foreign ships were relatively free, and which to some extent must have eventually increased the cost of navigating American ships. The sailor thus remained in debt to the ship for perhaps a month or more, and indeed was generally continuously in a state of debt and dependency. Therefore, the incentives to good conduct and the development of professional skill were weak, and morale was low.[127] Although the United States Shipping Commissioners' offices were intended to be employment offices, the strongly organized boarding-house keepers prevented their effective use,

[126] A.R.C.N., 1895, p. 36.
[127] A.R.C.N., 1895, p. 34.

and in one case actually picketed the office at San Francisco.[128] In this opposition they were aided by shipmasters, who evidently felt that they could secure crews at lower rates through the crimps.[129] Furthermore, although Congress had by the Act of June 26, 1884,[130] made it unlawful to pay advances of any kind, a measure which would have abolished the crimping system, the owners, boarding-house masters, and others who were injured secured a modification in the Act of June 19, 1886, which allowed allotments up to any amount for the payment of debt — a change which completely nullified all regulation.[131] In 1894, for instance, 15,503 allotment notes were issued to creditors, chiefly saloon and boarding-house keepers, and only 732 to relatives.[132] Great difficulty was experienced by the shipping commissioners in controlling the issue of allotments because the boarding-house masters, who deceived, threatened with blacklisting and jail, and otherwise controlled the sailors, carefully coached them in their answers to the shipping commissioner when they were mustered to sign articles.[133] Furthermore, but little effective control was exercised over the labor conditions on board ship in general, and of the actions of masters and of mates in particular, until the White Act of 1898 was passed, which subjected mates to some control.[134] In general the Congress was satisfied with the often-reiterated statements of the owners that American ships paid the highest wages in the world. But the conditions existing on board ship, even more than the wage rates, were rapidly forcing self-respecting Americans to abandon maritime careers.

In contrast, in Great Britain, as the result of the efforts of Samuel Plimsoll, Lord Brassey, and others, a series of regulations were adopted which, although neither perfect nor always enforced, nevertheless recognized the particularly weak position of seamen and endeavored to prevent abuses and to increase efficiency.[135] The great consolidating Merchant Shipping Act of 1854 had dealt

[128] A.R.C.N., 1895, p. 28.

[129] A.R.C.N., 1895, p. 28.

[130] 23 U.S. Stat., p. 53.

[131] A.R.C.N., 1895, pp. 32–33; 24 U.S. Stat. 80.

[132] A.R.C.N., 1895, p. 33.

[133] Statement of the U. S. Shipping Commissioner of San Francisco, A.R.C.N., 1895, p. 39.

[134] Walter MacArthur, *The Seaman's Contract, 1790–1918* (1919), p. 221.

[135] Clapham, *Economic History of Modern Britain*, II, 409–411.

at length with seamen's accommodations, contracts, desertion, scurvy, apprenticeship, and boarding-house keepers.[136] In 1867 accommodations were again ordered improved, the daily issuance of an anti-scorbutic, chiefly lime juice, was required, and ships were made liable for wages during illness caused by improper food or drink.[137] Samuel Plimsoll, a radical member for Derby, secured in the famous Act of 1876 the regulation of the load line and of the stowage of grain and other cargo, and the declaration that the sending of an unseaworthy "coffin" ship to sea was a misdemeanor [138] — a type of regulation which was needed in the American marine. Subsequently, further legislation was taken which restricted the amount of the advance which could be given by a British owner or captain and rigidly controlled the action of crimps in British ports.[139] Furthermore, the position of the seamen was notably improved by the alteration of the laws similar to those which had been in force in the United States since 1790, under which seamen deserting their vessels were imprisoned and forfeited their wages. British owners complained, however, of the resulting lack of control over desertion.[140] This change, which applied to home ports only, provided greater protection against unjust contracts. Thus, although such regulations were not always properly enforced, seamen were given some protection against abuses such as occurred in the American service.

12

To return to the comparative costs of manning, it is evident that a substantial differential, which was generally from 25 to 50 per cent, existed against American sailing ships throughout the period. Shipmasters, who were the responsible managers and direct representatives of the owners, generally received between $125 and $200 per month on deep-sea ships, according to the size of the vessel, the voyage, and the ability of the man.[141] Masters had by this time generally ceased to be part-owners of the ship or cargo, but they were generally native-born Americans and still retained a considerable amount of the former prestige. Beginning

[136] 17 & 18 Vict. c. 104.

[137] 30 & 31 Vict. c. 124.

[138] 39 & 40 Vict. c. 80.

[139] 57 & 58 Vict. c. 60; A.R.C.N., 1895, pp. 181-192.

[140] There was much opposition to this law among the owners and local officials. See A.R.C.N., 1895, pp. 185-189.

[141] Statement of R. P. Buck & Co., Lynch Report, p. 206.

in 1898 the masters and chief mates of sailing ships of 700 tons or more were required to have licenses, for which they were examined.[142] Subordinate officers were poorly paid, however, the chief mate receiving between $50 and $70 per month, and the second mate between $35 and $45 per month. Able seamen obtained as a rule from $25 to $30 per month in the late 'sixties,[143] but by the late 'nineties, as a result of pressure, the rates were generally between $15 and $20 per month, from which advances, debts, outfits, and other expenses had to be paid.[144] The rates on British deep-sea sailing ships were considerably lower, the masters getting about $95 per month, the chief mates from $35 to $40 per month, and able seamen from $13 to $18 per month.[145] The rates paid on German and Norwegian ships were somewhat lower still. On the whole, wage rates remained remarkably stable throughout the period from 1870 to 1900.

In summing up the various factors, it may be estimated that during this period the approximate cost of manning and victualing an American ship of 1000 gross tons was between $1100 and $1250 per month, and that that of a similar English ship was between $650 and $800 per month, that of a German ship between $600 and $750 per month, and that of a French ship between $850 and $1000 per month.[146] It follows that even had foreign ships been freely purchased, American shipowners would have found difficulties in competing under normal conditions unless they had possessed a great superiority in vessels or in general efficiency.

13

The period between the Civil and World wars was a crucial one so far as American navigation policy was concerned. Until the Civil War the maritime industries had possessed on the whole

[142] 30 U.S. Stat. 764.

[143] Statements of R. P. Buck & Co., and A. A. Low & Bros., Lynch Report, pp. 206, 208.

[144] A.R.C.N., 1901, pp. 77–78.

[145] A.R.C.N., 1901, p. 99.

[146] Lynch Report, pp. 206–208. Messrs. R. P. Buck & Co., a Maine shipping firm, estimate the monthly charges as $1110 for the American ship, $924 for the French ship, and $721 for the British ship. A. A. Low & Co. of New York give a figure of $1250 for an American ship. Actual returns from the fleet of R. P. Buck & Co. are as follows: 563-ton bark, twelve persons, $695 per month; 1308-ton ship, twenty-one persons, $1125 per month; 1506-ton ship, twenty-five persons, $1365 per month.

a competitive advantage over those of foreign countries, and a comparative advantage over domestic industry. It had consequently been possible to pursue a policy oriented toward free navigation and laissez-faire without antagonizing the normally mercantilistic shipping and shipbuilding industries or jeopardizing the national defense. Such, however, was no longer the case, and hence more vital decisions regarding policy were required. Many of these problems concerned contract subsidies and the role which the United States should have in steam navigation. The basic problems were presented, however, in their simplest terms in the case of the sailing-ship fleet, which encountered relatively simple and fair international competition.

The basic questions of policy in this case were, therefore, as follows. First, should American sailing-ship owners be allowed to purchase cheaper and better ships abroad? Second, if this were done what additional measures, if any, should be taken to secure participation in the foreign carrying trade? Third, if the shipbuilders were protected, what additional measures should be taken to aid the shipowners? Fourth, was it desirable to preserve the navigation monopoly in the coastwise trade, which greatly protected the owners of sailing ships against the competition of steam tramps? Fifth, what measures were necessary to improve the efficiency of the sailing marine and eliminate the existing abuses? Of these problems of technique, the question of free purchase of ships was of overwhelming importance. Overlying all, however, was the question of the value of the sailing marine to American commerce and defense and of the desirability of supporting it.

The question of free ships first became important at the close of the Civil War, when the problem arose of readmitting to American registry some 400,000 gross tons of American-controlled sailing ships which had been placed under the English flag during the war because of high costs and the operations of the Confederate privateers.[147] The government had, indeed, taken no measures to prevent such transfers, which in fact had commonly been made by the shipowners of all nations in former times, and the country had probably benefited from the earnings secured by these vessels during the war. This question probably was not vital to the owners concerned, for many were reasonably well

[147] Nimmo Report, p. 9; Lynch Report, p. 97.

satisfied to fly the British flag, but it was of vital importance for the future of the American shipping industry. The shipbuilders, who mistakenly believed that they would receive more orders if these and other foreign ships were excluded, opposed such reentry, and they were supported by the Lynch Committee, which belatedly denounced the owners of the ships as "traitors."[148] Hence the principle of high protection was established.

The years between 1857 and 1880 were of primary importance in the subsequent struggle for free ships, because during this period the major business decisions to restrict, abandon, or change the flag of existing maritime enterprises were taken. The maritime interests were hopelessly divided at this time on this issue. The shipowners engaged in the highly competitive trans-Atlantic trades correctly argued that they could not maintain their businesses in competition with British iron steamships by using American-built wooden or iron ships.[149] In this position they were supported by many of the firms in the long-voyage trades, which firms, although not so much influenced by steam competition as the first group, nevertheless desired to secure iron tonnage cheaply. Probably the outstanding advocate of free ships at this time was Captain John Codman, a shipmaster of long experience, whose books, pamphlets, and numerous statements before Congressional committees summed up the case for this group.[150] In opposition to any change in the law were the builders of wooden and iron ships, shipyard labor, the Navy, some of the Maine shipping houses with shipbuilding connections, and mercantilistic and nationalistic elements generally. The builders of wooden ships simply recognized the superiority of metal vessels, for the most part, and asked for protection as a vested interest. The builders of iron ships at first argued that they could construct ships as cheaply as the British, but when this proved to be impossible they argued that their business was an infant industry which deserved protection. Led by Mr. John Roach, the shipbuilder of Chester, their case was fully presented at each inquiry.[151] Their industry was infantile in the sense that experience and larger-scale operations were certain to increase efficiency,

[148] Lynch Report, pp. xi–xiv.

[149] Statement of J. S. Williams of Williams & Guion, shipowners, Lynch Report, pp. 33–34.

[150] See Codman, *Free Ships* (1886), *passim.*

[151] See for instance John Roach's statement in the Dingley Report, pp. 77–115.

but such improvements could scarcely have enabled it to compete in the international ship market at any time. Furthermore, they overlooked the fact that an important group among the owners was unprotected, and hence the orders which might produce economies would not be forthcoming. Another argument, which in this case had little validity, was that protection was essential for national defense. The primary weakness of all these arguments for protection was that it was impossible to show how capital for investment in ships for the foreign trade was to be secured on a large scale in the absence of the establishment of a subsidy policy or a navigation system.

The situation clearly called for the repeal of the registry law, but although free-ship bills were presented at nearly every session of Congress, nothing was done until 1912, when it was too late to preserve the entrepreneurial talent, contacts, good will, and economies of the shipping industry. None of the arguments for protection were economically valid so far as sailing ships were concerned. The owners in foreign trade ordered few vessels; the yards employed few workmen; only a handful of wooden ships were made available for national defense purposes; and American seamen were neither trained nor maintained. In general, nevertheless, great solicitude was shown for the shipbuilders by the Lynch, Dingley, and Farquhar Committees of 1869, 1882, and 1890, respectively, and the Merchant Marine Commission of 1905, although the economics of the situation was made plain by testimony.[152] There was also the excellent example of the British action in 1849. It soon became apparent, indeed, that only with the purchase of foreign steamships and sailing vessels could costs be substantially reduced, efficiency increased, and the margin which might allow of expansion and manning reforms be secured. Furthermore, the development of shipping in the coastwise trade was also greatly hampered by the same conditions. Finally, in 1912, after repeated failures, the Congress authorized the purchase for use in the trade to foreign countries and the Philippines of foreign-built ships which were not over five years of age.[153] This latter provision eliminated the possibility of the dumping of secondhand tonnage here, a contingency which was feared by

[152] See for instance the statement of James Rolph, the leading sailing-ship operator of the Pacific Coast, R.M.M.C., II, 1181–1185.

[153] 37 U.S. Stat. 562 (Aug. 24, 1912).

the shipbuilders but was nevertheless unlikely to occur. In 1914, the free purchase of foreign ships was allowed without restriction, except that the operation of such vessels in the coastwise and other protected trades was forbidden.[154] By then, however, the age of sail was over, and that of war, nationalism, and subsidy struggles was beginning. The policy of protecting the shipbuilders, which was so deeply ingrained in American thinking, was to be continued in other ways, however.

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Although it is probable that, given free ships and the unrestricted use of foreign seamen, a considerable amount of American square-rigged tonnage could have been successfully operated in the foreign trade, the actual position of the shipowners was such that only strong protection could have entirely saved them. This could have taken the form either of subsidies or of a system of navigation monopolies and discriminations tending to eliminate the ships of each foreign nation from all but the direct trade with that nation. Although there was pressure in some quarters to revive the latter system, for shipowners recognized that it was likely to be the most effective policy, nevertheless the reëstablishment of such a course was not seriously considered because of the danger of general commercial retaliation, the injury to shippers which would have occurred, and the difficulties which would have been encountered in denouncing the network of reciprocity treaties. Consequently most owners favored a subsidy of a substantial amount, and bills for this purpose were frequently introduced.

The sailing ship interests were, however, strongly opposed to contract subsidies, which were always given to steamships,[155] and, instead, urged that a general navigation bounty on the French model be given. Such a system, if the bounties were of sufficient size, would have effectively and economically expanded the sailing marine, and would have avoided the abuses inherent in the contract system, although the elasticity of the supply of wooden ships was less than that of metal vessels in France, and hence the effect would have been less than was the case in that country.

[154] 38 U.S. Stat. 698 (Aug. 18, 1914).

[155] See for instance Codman, *The Injustice of Granting Subsidies to Steamship Companies* (1871), Harvard College Library Pamphlet Collection.

It proved to be difficult to justify such a large and unlimited expenditure to the Congress, however, for shippers were being adequately served by foreign vessels, and sailing ships appeared to be of little value in war time. It was, in fact, generally argued that France was receiving no suitable recompense for her expenditure, and this was probably true.

Hence all of the general bounty bills failed in Congress. The Lynch bill of 1870, which provided for large bounties to shipbuilders and moderate ones to shipowners, including the sailing-ship operators in the coastwise trade, was severely attacked by free traders and free ship interests and was lost. There were stronger reasons for subsidizing coastwise shipping than foreign-trade shipping, for the shippers using vessels in the former trade were being forced to pay well in money and inefficient service because of the use of high-cost American-built vessels, chiefly wooden sailing craft. The Congress was unwilling, however, to aid either branch of the business. The correct policy clearly was to secure the most efficient and lowest-cost equipment, abroad if necessary, to rationalize the various services, and then, if it was felt desirable, to grant subsidies for the further extension and improvement of transportation and communications, for which policy there was plenty of precedent in railway construction in the United States, Canada, France, Germany, and elsewhere. But it would have been difficult on such a basis to justify subsidies to wooden windjammers. During much of the debate, however, the broad issue of the use of subsidies to improve communications was not in question, but rather the narrow one of their use to protect the high-cost builders of obsolete and inefficient ships and the vested shipping interests. In this form the subsidy question was continually brought before the country.

The Frye-Farquhar bill, the outcome of the Farquhar Committee's investigation, which provided payments of thirty cents per gross ton for each 1000 miles sailed for all vessels of 500 tons and over built in the United States and operated in foreign trade, came up in 1890. In addition, the Frye bill of the same year providing mail subsidies for liners was introduced. Both were passed by the Republicans in the Senate, but in the House the Democrats, although passing the latter, defeated the navigation bounty bill. Thus the hopes of the owners of wooden sailing ships for a subsidy were dashed for a decade, although the steamship

owners received aid. It is notable that these measures antedated the heavy French bounty of 1893. A new protectionist philosophy was thus clearly rising on this side of the Atlantic as well. Under McKinley, Roosevelt, and Taft, all of whom advocated subsidies, further bills of the same type were introduced. Most important was the Frye bill of 1900, which was again promoted by Senator Frye of Maine, the champion of the maritime interests of that state. It provided for a general navigation bounty of fifteen cents per gross ton per 1000 miles for the first 1500 miles of both outward and homeward voyages, and for the remainder, ten cents per 1000 miles. In addition, bonuses were to be given to steamships according to size and speed. This bill, like its predecessors, failed because of the inability of its champions to prove that the measure was in the national interest. Finally the Merchant Marine Commission again recommended a bounty in 1905, but the resulting bill failed as had its forerunners. American owners of sailing ships thus never received any aid.

Meanwhile the square-rigged marine was rapidly declining, the leading houses were going out of business, and steamship operation was not developing satisfactorily. In the San Francisco grain fleets American participation fell from 35 per cent of the number of departures during the period from 1873 to 1877 to 34 per cent during that from 1878 to 1882, 33 per cent during that from 1883 to 1887, and 18 per cent during that from 1888 to 1892.[156] At Portland, Oregon, the tonnage of American and British square-rigged vessels departing was in 1883 respectively 26,000 and 58,000 tons; in 1888 the figures were 4,000 and 122,000 tons.[157] By 1903, of the 230 square-rigged ships which loaded there, 119 were British, 78 were French, 22 were German, and only one was American.[158] By the late 'eighties American ships were entering the grain trade in volume only if a shortage of tonnage appeared and favorable rates could be secured. Many lay

[156] Compiled from W. W. Bates, *American Marine*, p. 162. The figures are as follows:

Fiscal Years	*American*	*Foreign*
1873–1877	465	867
1878–1882	532	1034
1883–1887	509	1055
1888–1892	239	1070

[157] R.I.C., 1890, p. 767.

[158] R.M.M.C., II, 1033.

idle in West Coast ports,[159] and others found temporary employment in the lumber, oil, sugar, and coal trades, or awaited word regarding charters at Hawaii, Manila, or Shanghai. The construction of new grain ships on Puget Sound, where five were built, was halted at the turn of the century.[160] Even in the non-perishable cargo trades of the Pacific, American ships were being forced out by 1903, rates were at the laying-up point, and many vessels were idle.[161] Capital for investment in ship shares had been difficult to secure for some time.[162] The prices of shares in existing vessels fell rapidly between 1878 and 1888, sometimes by as much as 75 per cent, and numerous investors were consequently ruined.[163] A number of big firms, such as that of Thayer & Lincoln of Boston, failed during this period. Most vessels failed to earn much more than their prime costs, and consequently as they wore out they were not replaced. In 1893 the square-rigged fleet under the American flag consisted of but 186 ships, 285 barks, and 113 barkentines in comparison with the several thousand craft formerly operated, and by 1901, despite the addition of several score British-built steel ships and shipentines as a result of the annexation of Hawaii,[164] the numbers were 104, 157, and 80 respectively. In that year the Commissioner of Navigation correctly predicted that this type of vessel would practically cease to be seen under the American flag after twenty years.[165]

[159] Statement of G. F. Thorndike, R.M.M.C., II, 1029.
[160] Statement of G. F. Thorndike, R.M.M.C., II, 1001, 1036.
[161] Statement of G. F. Thorndike, R.M.M.C., II, 1027–1029.
[162] Statement of Mr. Nelson, a shipowner, Lynch Report, p. 36.
[163] Portsmouth (N.H.) ship Sales Books. The prices of shares of two ships, for instance, were as follows: (1) Ship *Grandee*, 1295 tons, built in 1873 by Tobey & Littlefield. (2) Ship *Paul Jones*, 1258 tons, built in 1877 by W. Fernald.

(1) *Grandee*		(2) *Paul Jones*	
1873 (new)	$79.80 per ton	1878	$69.90 per ton
1874	82.60	1881	25.44
1877	54.20	1882	24.80
1880	32.10	1883	35.60
1883	29.63	1884	25.43
1884	19.75		
1889	12.35		

These prices were secured from the prices given for fractional parts of the ship as recorded on the sales books, in which such matters were entered. It must be remembered that depreciation charges were not usually deducted at this time. Nevertheless a serious collapse is shown in those and many other similar figures.
[164] 31 U.S. Stat. 161 (April 30, 1900).
[165] A.R.C.N., 1901, p. 12.

There was, however, a considerable investment of American capital in foreign sailing ships, and an even larger one in foreign steamships, which was largely due to the registry law and the lower costs of operation under foreign flags. Many firms, when faced with the alternative of abandoning their business or making foreign connections, chose the latter. Consequently, as shareholders in limited companies, mortgage holders, shareowners, charterers,[166] and contracting managing owners, American firms and individuals owned and controlled a considerable amount of foreign tonnage, chiefly British. Some firms, such as Lord & Company of Boston, disposed of wooden tonnage and bought into fleets of iron sailing ships.[167] Others invested in Canadian wooden ships until these vessels became obsolete.[168] West Coast owners, such as James Rolph, registered vessels at Vancouver and Hawaii, there being about 1900 perhaps twenty such vessels controlled in San Francisco documented at the former port alone.[169] This form of shipping enterprise, although legally cumbersome, was efficient, and provided a considerable amount of American-controlled tonnage. Furthermore it is doubtful if the lack of legal authority on the part of the government over such sailing vessels was a serious weakness. Had it been possible to use these foreign-flag craft in the coastwise trade, it is likely that nearly the entire deep-sea fleet would have been documented in convenient foreign centers. This change of flag may, however, be considered as an evidence of the previously-mentioned unnecessary weaknesses in the American navigation policy.

[166] Statement of J. M. Forbes, Boston shipowner, son and successor of R. B. Forbes, Farquhar Report, p. 272. In this case the investment consisted of a 980-ton Clyde-built clipper which was under perpetual charter.

[167] Dingley Report, p. 50.

[168] Wallace, *Wooden Ships and Iron Men*, pp. 248, 282, 297, 302; F. W. Sprague, *Barnstable and Yarmouth Sea Captains and Owners* (1913), p. 21.

[169] Statement of James Rolph, leading sailing ship owner of the Pacific Coast, R.M.M.C., II, 1184–1185. Mr. Rolph himself had operated two ships under Hawaiian registry, the bark *Homeward Bound* and the barkentine *Hawaii.*

CHAPTER XIV

METAL STEAMSHIPS AND THE SHIPBUILDING PROBLEM, 1863–1914

I

DURING THE PERIOD between the Civil and the World wars important changes occurred in the sector of steam navigation which created the modern marine transportation system. First, in ocean commerce metal steamships displaced wooden ones, the change coming, so far as new construction was concerned, in the British merchant marine in the late 'fifties, and in that of the United States in the 'seventies. Second, both the shipping and shipbuilding industries became organized in large-scale enterprises involving heavy investments in capital goods and the use of the methods of scientific management. Third, the localization pattern of both industries became greatly altered because of the use of new economic resources. Fourth, both industries were more widely regarded as essential for the welfare and security of the state, with the result that governments instituted new and far-reaching measures of support and control.

The industry of building iron and steel steamships naturally played a leading role in this development. Unlike that of building wooden ships it became extremely complex, both technically and economically. It came to stand at the apex of a pyramid composed of heavy industries, close contact with which was essential for its development. Of special importance were the iron and steel industry and the many engineering industries. These businesses produced the essential raw materials and fabricated parts and made the shipyard equipment. Technical leadership of a high order became essential. Hence shipbuilding tended to become localized principally in the nations possessing well-developed heavy industries. Coal deposits, which attracted heavy industry because of the importance of minimizing transportation costs; low freight charges between the centers of heavy industry and the shipyards; and an advanced industrial organization were, in general, basic conditions for large-scale shipbuilding. In these re-

spects Great Britain, France, Germany, and the United States were the nations best fitted for shipbuilding. Few centers could rival Great Britain, however, which possessed coal mines and iron and steel mills located near to the seaboard in many places, especially on the Clyde, which became the greatest shipbuilding center in the world. Germany, which in the latter part of the century developed her shipbuilding industry with the aid of the heavy industries of Westphalia and Silesia, found it necessary to grant special freight rates on the state railroads in order to reduce costs, and even then could not secure as favorable a level of supply prices. In France the distance between the steel works of the northeast and the shipyards also created a problem. The United States, where the chief coal supplies were located some distance inland, principally in the Ohio valley, the iron ore came long distances from the newly opened ranges of Minnesota, and the labor supply was comparatively costly, was the least favorably placed for shipbuilding of the major industrial nations. The principal problem of this period in the United States, therefore, was how to deal with this fact.

A complicating factor of the first magnitude was the appearance of conditions of increasing return on a large scale in the shipbuilding industry. By the end of the century important internal economies were to be secured from large-scale operations in an individual plant. Only if the plant were large and a number of vessels in various stages of completion were normally on the ways was it economical to purchase or build the numerous heavy specialized tools and appliances which were necessary if costs were to be kept at a minimum. In smaller plants the overhead costs and large percentage of idleness made the use of such machinery uneconomical. Furthermore, only in large shipyards was an efficient use of labor possible. There were also important external economies resulting from large-scale production in the industry as a whole. These resulted from specialization by each shipbuilder in the construction of a particular type of vessel, the development of many specialized engineering industries, the adaptation of heavy industry in general to supply shipbuilders' demands, and a widening of the labor market. Thus the shipbuilding industry was likely to be ill-equipped, technically backward, poorly organized, and poorly supplied with labor and materials when operating on a small scale, whereas when conducted on a large scale

the reverse was true. It follows that in those centers where the industry first reached maturity further advantages were secured owing to these economies, and that in many other places it was likely to be an economic infant. In some of these it was susceptible of being nursed into considerable vigor by means of subsidies or other aids.

The rise of the industry of building iron steamships was based on the many advantages of iron both in navigation and construction. Shipowners came to prefer iron for steamships for a number of reasons. First, in large vessels iron construction gave much more deadweight carrying capacity and internal volume than wooden construction. It was necessary to build very heavily the wooden steamers of 2000 gross tons or more in order to enable them to carry the great weight of their machinery safely. Hence these vessels were built with the heaviest possible frame timbers, which were laid solidly and were reinforced by strapping, and with great keelsons, many stanchions, and other reinforcing pieces, all of which added to the weight and took up space. Such wooden hulls were often as heavy as their cargoes, whereas iron-hulled steamers were often but one half as heavy.[1] This advantage tended to increase with size.[2] Hence by 1860 the big wooden steamer had become obsolete. With the increases in the tensile strength of iron plates the advantage increased still further. In the early 'fifties the tensile strength had been between 16 and 22 tons per square inch, but by the early 'sixties it had been increased to between 30 and 35 tons per square inch, thus enabling the weight of the hull to be reduced.[3] Secondly, large iron hulls could be much more securely fastened. It was difficult to prevent loosening in a large wooden steamship as a result of the working of the hull in a seaway. The pounding of a screw propeller was particularly difficult to meet. Third, by using iron, vessels could be built of a size and speed far greater than that possible with wood. Indeed, in almost every technical and economic aspect the large iron steamship was superior to the wooden one. Therefore it was of the utmost importance that iron steamships be supplied to American owners at reasonable prices.

[1] Pollock, p. 40; Fletcher, p. 194.

[2] William Fairbairn, *Treatise on Iron Ship Building, its History and Progress* (1865), pp. 4–6, 64–65; John Grantham, *Iron Ship-Building* (1868), pp. 86–114.

[3] Grantham, "On the Classification of Iron Ships," *Trans. I.N.A.*, II (1861), 137.

The use of iron also increased the economic efficiency of the shipbuilding process. Builders were no longer fettered by lack of timber of sufficient size or shape. Iron frames could be readily bent to any desired form, and it was possible to devise types of construction which gave ample strength to hulls much larger than any which had been formerly built, as the construction of the *Great Eastern* clearly indicated. Shipbuilding no longer was a craft industry in which each piece was separately fitted, but, instead, became an assembly operation in which pieces were cut and punched according to patterns and were placed in the hull according to a schedule. Such operations as riveting and caulking were reduced in importance as the length and breadth of shell plates increased. To a much greater extent than formerly operations became mechanized. Thus the use of iron opened up wide new fields in the technique of building ships.

The development of the iron steamship naturally occurred with greatest rapidity in Great Britain, where the iron and engineering industries were most advanced. By 1831 the industry was well started, there being shipyards on the Thames, Mersey, Clyde, and East Coast of Scotland.[4] John Laird, the pioneer Mersey shipbuilder, had a yard at Birkenhead as early as 1825, at which several pioneer iron steamships were built.[5] Between 1835 and 1850 William Fairbairn, a Manchester mill builder who was to become one of the foremost constructors of iron vessels in the world, built over one hundred iron craft on the Thames.[6] Iron steamers for the coastwise coal trade began to be built in considerable number after 1830. Iron ships were still rare and costly by 1847, however, it being doubtful if 150 iron seagoing vessels had yet been built.[7]

Between the mid-'forties and early 'sixties iron hulls found an increasing acceptance in ocean service in both the British Navy and the merchant marine. The Peninsular and Oriental Company experimented with an iron ship as early as 1843, and the results were so satisfactory that B. M. Willcox, the managing director, stated that "in my opinion eventually almost all steam vessels

[4] Fletcher, p. 196.

[5] Clapham, *Economic History of Modern Britain*, I, 439–440.

[6] Clapham, *Economic History of Modern Britain*, I, 439 n; Fairbairn, *Treatise*, pp. 4–5.

[7] Clapham, *Economic History of Modern Britain*, I, 440.

will be built of iron." [8] Willcox had discovered that in England iron steamships cost from 10 to 15 per cent less than wooden ones, and were more durable.[9] Only orders from the Admiralty, which was opposed to iron ships because of their vulnerability to solid shot, prevented at this time the rapid increase in the number of iron ships on the contract mail services.[10] The completion in 1844 of the Great Western Line's famous steamship *Great Britain*, which survived shipwreck and saw service for sixty years, was a pioneer achievement which did much to cause the acceptance of the iron ship.[11] The building of this vessel failed, however, to induce the British Admiralty and its contractors to abandon wooden ships. In contrast, independent operators, who were not controlled by Admiralty regulations, quickly turned to iron in the 'fifties. One of these, the Inman Line, brought out in 1850 as its first vessel the iron single-screw steamship *City of Glasgow* of 1069 gross tons, 350 horsepower, and a capacity for some 500 passengers, chiefly third class, which ship was built by Tod and MacGregor at Liverpool.[12] She was followed by the 2125-ton *City of Manchester* and other similar ships, which because of their lower cost and the emphasis laid by the company on the immigrant trade were able to compete successfully with the subsidized Cunard vessels.[13] Competition of this sort and the development of explosive shells caused the Admiralty in the mid-'fifties to abandon its position against iron construction for mail ships, and hence the mail contractors soon began to shift to iron, beginning with the Cunard liner *Persia* in 1855.[14] Indeed, by 1858 the Admiralty was requiring the Royal Mail Company to build iron steamships of 3000 gross tons for the South American trade.[15] The possibilities of iron construction were further shown by the building of the *Great Eastern*, which was designed in the years

[8] *Report of the* [British] *Select Committee on Merchant Shipping* (1844), p. 86.
[9] *Report of the* [British] *Select Committee on Merchant Shipping* (1844), p. 87.
[10] *Correspondence between the* [British] *Lords of the Admiralty and the Steamship Companies Relative to the Exclusion of Iron Steamships from the Packet Service*, Parliamentary Papers, 1851, vol. LI, no. 86.
[11] Kirkaldy, pp. 65–66.
[12] Jackson, pp. 136–137.
[13] R. J. Cornwall-Jones, *The British Merchant Service* (1898), p. 187.
[14] Lindsay, *History of Merchant Shipping*, IV, 226.
[15] *Returns and Correspondence Regarding East Indian, South American, and Australian Contract Mail Services* (1858), Parliamentary Papers, 1857–58, vol. XLI, no. 144, pp. 5–11.

1852–1853 and was finally launched in 1858. Measuring 18,914 gross tons and 675 feet in length, she was the joint product of I. K. Brunel, the designer, and J. Scott Russell of London, the builder, who were among the foremost constructors of iron ships in England. Although she ruined her builders and owners, her construction was a major technical achievement. Another pioneer achievement was the completion in 1861 of the first great armored warship, H.M.S. *Warrior*, 6109 gross tons, which carried 1200 tons of armor.[16] The successful construction of these ships clearly showed that in the future iron ships would dominate, in both navies and merchant marines.

The industry of building iron ships in Great Britain had thus reached a stage of comparative maturity by 1862. Many of the leading shipbuilders, such as William Fairbairn, could point to some thirty years of successful construction.[17] Iron had been shown to be a material superior to wood for all craft except small sailing ships. Lloyd's Register had drawn up rules for construction and scantling embodying the considerable cumulative experience of the industry. The Institution of Naval Architects, the first scientific society in this field, had been founded on January 16, 1860, by the builders of iron ships, in order to provide a means of pooling and circulating technical knowledge.[18] Its *Transactions* soon achieved a position in the forefront among technical publications. One of its objectives was to place Great Britain in the lead in the design and construction of war and merchant steamers.[19] In the yards machines were being developed to perform much of the shop work which had been done by hand in the building of the early iron steamships. The Royal Navy, which had secured its first iron warship, H.M.S. *Birkenhead*, in 1845,[20] was beginning to support the shipbuilders by means of heavy contracts for armored war vessels — an effective backlog of business which American builders then lacked. Naval architects were beginning to study scientifically the laws of form and

[16] Sir John S. Pakington, "Introductory Address," *Trans. I.N.A.*, III (1862), xix; Fairbairn, *Treatise*, pp. 103, 218–225.

[17] Fairbairn, "On the Construction of Iron-Plated Ships," *Trans. I.N.A.*, IV (1863), 1.

[18] "Account of the Purposes and Formation of the Institution of Naval Architects," *Trans. I.N.A.*, I (1860), xv–xx.

[19] Pakington, "Inaugural Address," *Trans. I.N.A.*, I (1860), 4.

[20] Clapham, *Economic History of Modern Britain*, I, 440.

propulsion. By 1870 they were to have the advantage of the experimental work done in Dr. Froude's towing tank at Tourquay in Devonshire.[21] Not until 1882, however, was a British firm, William Denny and Sons, to have a tank of its own. Thus both technically and economically shipbuilding was in an advanced state in Great Britain by the beginning of the 'sixties.

In marine engineering great strides were also being made. The screw propeller, which had been originally applied to ship propulsion by Colonel John Stevens early in the nineteenth century, was developed in the late 'thirties independently in England by Thomas P. Smith and in America by the Swedish engineer John Ericsson. It was more rapidly perfected in the British Isles, however, for it was used in the pioneer iron liners *Great Britain* and *City of Glasgow*. Screws were much less desirable in wooden steamers than in iron ones because of the lack of rigidity of the wooden hull, and the tendency of fastenings to loosen under vibration. Hence screws were not widely used on American wooden liners. Unfortunately, however, paddle wheels were relatively inefficient in ocean steamers, owing to the impossibility of maintaining a proper level of emersion when rolling and pitching in a seaway and to the necessity of operating the ship at a given draft. Another important forward step was the development of the compound engine, whose principle had been understood at least since Jonathan Hornblower took out his patent in 1781[22] but which had been little used until the middle of the nineteenth century. Marine engines of this type were built by John Elder, the rising Clyde shipbuilder, in the years 1854–1856.[23] They produced a notable increase in engine efficiency. An engine of this type was introduced in large ocean-going liners for the first time on the Peninsular and Oriental liner *Moultan* in 1861.[24] Also of great importance was the notable development of the machine-tool industries in Great Britain, which resulted in a substantial improvement in the efficiency of marine engines. Precision tools and gauges, standardized threads, interchangeable parts, and other improvements were made as the result of the work of Wentworth, Armstrong, and others.[25] Thus by the early

[21] Pollock, pp. 84–85.
[22] Clapham, *Economic History of Modern Britain*, II, 71.
[23] Clapham, *Economic History of Modern Britain*, II, 71.
[24] Clapham, *Economic History of Modern Britain*, II, 72.
[25] Clapham, *Economic History of Modern Britain*, II, 74–76.

'sixties the British builders of marine machinery, like those of iron hulls, had made great advances and stood foremost in their field in the world.

2

In contrast, the industries of building iron ships and marine engines lagged far behind in the United States. The conditions chiefly responsible for this were the high cost of domestic iron at the seaboard, the relative cheapness of wood, and the backwardness of the engineering industries. Consequently these maritime industries dragged out a precarious existence until the latter 'nineties, when industrial maturity, the rise of naval construction, and the growth of the coastwise shipping industry induced a substantial expansion. Until then, however, those industries were economic infants, whose disadvantages were too great to allow of rectification by means of protection alone.

The industry of building iron ships was established in the United States in the 'thirties. The first vessels to be built were probably the river paddle steamboats *John Randolph*, 122 tons, *Chatham*, 198 tons, and *Lamar*, 196 tons, which were erected at Savannah in 1834, 1836, and 1838, respectively, of iron imported from Liverpool.[26] The importation of English iron was soon checked by the tariff, however, and hence the industry became centered on the Delaware, where supplies of domestic iron were most easily secured. It is impossible to date the establishment of the industry there because of the loss of the master carpenters' certificates for the years prior to 1849. According to Cramp, however, the first vessel was a small iron barge, which was built by Jesse Starr, a boiler maker of Kensington, in the early 'thirties.[27] By 1844 the industry had become well established, there being at least three builders on the river engaged in the construction of tugs and river boats of from 65 to 300 gross tons.[28] The leading firms were Reaney, Neafie & Company at Philadelphia and Betts, Harlan, & Hollingsworth at Wilmington. A pioneer achievement by the latter firm was the building in 1844 of the

[26] Lytle, "The Construction of Iron Ships in the United States, 1834–1872," A.R.C.N., 1889, Appendix L, pp. 217–219.

[27] Cramp, "The Evolution of Screw Propulsion in the United States," 2 pts., *Trans. S.N.A. & M.E.*, XVII–XVIII (1909–1910), pt. I, p. 156.

[28] Lytle, "The Construction of Iron Ships in the United States, 1834–1872," pp. 217–219; a register of the ships built is given.

three-masted twin-screw coastwise liner *Bangor*, 212 tons, for the Boston–Bangor service. This ship was the first substantial iron sea-going vessel to be built in the United States.[29] There was also some construction of small iron barges and towboats at New York during the 'forties and 'fifties, but operations were extremely irregular. At Boston iron vessels were also occasionally built, beginning about 1845 with the iron steam tug *R. B. Forbes*, 329 tons, which was built by Otis Tufts for R. B. Forbes, the pioneering Boston owner.[30] Two more early vessels, which were also built by Otis Tufts for the account of R. B. Forbes, were the screw steamer *Argentina*, 118 tons, which was built in 1857 and was used to survey the River Plate, and the brig *Nankin*, already mentioned, which was employed in the China trade.[31] The total amount of documented iron steam tonnage built in the United States was extremely small prior to 1860, the average annual output for the decade of the 'forties being but 455 gross tons, and for that of the 'fifties but 1515 gross tons.[32] Hence the industry can scarcely be said to have been in a flourishing condition in comparison with that of building wooden ships, both sail and steam.

The established shipbuilding interests refused, for the most part, to take any part in the construction of iron ships. Indeed, they rather despised such vessels, and with some justification. The early builders of iron vessels were, therefore, usually boiler makers, iron founders, and machinists. For instance, Thomas Reaney, who founded Reaney, Neafie & Company, had been foreman of a boiler shop,[33] and John Roach, who was to become the foremost advocate of the interests of the builders of iron ships, had been an iron founder and engine builder.[34] Boiler makers, engine builders, and other iron workers secured a dominating position because of their ability to work accurately to plans.[35] There was much similarity, in the cutting, bending,

[29] C. E. Hyde, Discussion of a Paper by C. H. Cramp, *Trans. S.N.A. & M.E.*, XVIII (1910), 56–57.

[30] Lytle, "The Construction of Iron Ships in the United States, 1834–1872." See the list of Boston-built vessels.

[31] Lytle, "The Construction of Iron Ships in the United States, 1834–1872"; Lindsay, *History of Merchant Shipping*, IV, 193–195 n.

[32] A.R.C.N., 1914, p. 199.

[33] Cramp, "The Evolution of Screw Propulsion," pt. I (1909), p. 156.

[34] Cramp, "The Evolution of Screw Propulsion," pt. II (1910), p. 55.

[35] Horace See, Discussion, *Trans. S.N.A. & M.E.*, XVII (1909), 161.

punching and fastening of the plates, between the two kinds of work. It was necessary, however, for the iron workers to employ the builders of wooden ships to design the model, to lay the ship down in the mold loft, and to superintend the bending and erection of the frames, and the launching.[36]

The methods employed in building iron hulls were very inefficient at this time. The technique of drafting was poorly developed and little used, and the waste of material and labor was consequently great. No specifications were sent to the mills, and hence it was necessary to cut frames and other pieces to the proper size in the yard. Over a third of the shell plating was often wasted owing to mistakes in cutting and punching. Indeed, the difficulties encountered in shaping the plating produced some oddly formed vessels. Builders were, in fact, accustomed to work up their design as they went along, and accordingly full plans were rarely made. Hence when in 1860 the Navy asked for tenders for monitors, to be accompanied by detailed plans, only one complete set appeared among thirty proposals.[37] Furthermore, there was little coördination between the ship and engine builders, with the result that there was inefficiency and waste.[38] Thus prior to the Civil War the American industry of building iron ships was comparatively backward and, in fact, had not constructed one major vessel, although English yards had been turning out large metal liners for over a decade.

3

During the period between the Civil War and 1914 the technical capabilities of the industry notably improved, but its economic position failed to do likewise, and probably became worse. The Civil War itself was a stimulating factor of some importance, but its influence was short-lived. During the entire period the bulk of the commercial construction consisted of liners for the coastwise trade and the subsidized services to foreign countries. There was little building for the overseas trade in general. Beginning in the 'eighties, however, the volume of warship construc-

[36] Cramp, "The Evolution of Screw Propulsion," pt. I (1909), pp. 157–158. Reaney, Neafie and Company employed the firm of William Cramp and Sons for this purpose under sub-contract.

[37] Cramp, "The Evolution of Screw Propulsion," pt. II (1910), p. 51.

[38] Cramp, "The Evolution of Screw Propulsion," pt. I (1909), pp. 158, 161.

tion began to increase until it rivaled that of merchant ship construction.

The first important stimulus to the builders of iron ships came from the construction of armored vessels for the Navy during the Civil War. The Navy had been for several years considering the construction of iron-clad ships, which had been successfully used in European navies during the Crimean War.[39] Finally, orders were given to construct three monitors or seagoing rafts fitted with revolving turrets, the *Monitor*, *Galena*, and *New Ironsides*.[40] The success of the action between the *Monitor* and the Confederate armored gunboat *Virginia* subsequently caused the Navy to order thirty-five more such craft,[41] and the construction of these vessels, for which the government paid high prices, greatly contributed to the expansion of the industry.[42] The success of certain firms in building these unseaworthy and costly craft had the unfortunate effect of inspiring an unwarranted confidence that commercial construction could be economically undertaken. Engine building also received a stimulus from the numerous orders secured for the machinery of the monitors, new screw sloops-of-war, paddle steamers, and gunboats which were hastily added to the fleet. Many new contractors appeared in the field for the first time. This business was then centered chiefly in Philadelphia, New York, and the industrial towns of Connecticut and Rhode Island.[43] The net result of this episode was, however, comparatively small. The shipbuilders secured little experience in the construction of large iron seagoing war or merchant ships, for the monitors were scarcely more than small coast-defense craft. Furthermore, the policy of building iron warships was discontinued after the war. Hence the shipbuilders had little opportunity to secure experience, develop their equipment, and obtain economies from large-scale, continuous operation.

Following the Civil War the economic position of the builders of iron ships remained extremely weak for more than two decades, although some progress was made. Most of the firms which had built iron warships collapsed with the cessation of naval construction. The construction of iron steamships, however, increased

[39] J. P. Baxter, *The Introduction of the Ironclad Warship* (1933), p. 86.
[40] Baxter, chap. xii.
[41] Sprout, p. 160.
[42] Cramp, "The Evolution of Screw Propulsion," pt. II (1910), pp. 51–52.
[43] Lynch Report, pp. 248–253.

considerably. From an average of 1515 gross tons a year in the 'fifties, output rose to averages of 6266 gross tons in the 'sixties, 18,688 gross tons in the 'seventies, and 37,428 gross tons in the 'eighties.[44] This output was insignificant, however, in comparison with that of Great Britain.

During the 'sixties there was little progress in the building of seagoing liners and freighters, although a large amount of tonnage of this type was being built abroad. For the most part the domestic output consisted of small river boats and tugs, although larger vessels appeared more frequently than formerly. Few large American iron liners for the foreign trade came out in the 'sixties. Two notable vessels were the *Mississippi*, 2008 tons, and the *Merrimack*, 1991 tons, which were built by Harrison Loring at Boston in 1862 for the South American trade. Indeed, as late as 1870, of the thirty-six American liners engaged in foreign trade, only three were of iron, and of these two, the *City of Port-au-Prince* and the *Lavaco*, were small West India packets. The Brazil liner *Merrimack* was then the sole large off-shore iron liner.[45] At the same time all of the 102 British, German, and French liners sailing regularly to the United States were of iron construction.[46] A number of iron coastwise liners were, however, placed in service on the New York and Savannah, New York and Charleston, and New Orleans and Galveston services. The construction of iron screw colliers ranging from 700 to 1000 tons for the coastwise coal trade was also begun at Wilmington and other places.[47] A small export business in tugs and river craft to South America also developed, for in this business the American yards had the advantage of not having to dismantle their vessels for shipment.[48] The builders found, however, that although they had many inquiries regarding larger ships, most of the business went to English shipyards. Those on the Clyde, Mersey, and Tyne, which had become the chief shipbuilding centers of the world, had, in fact, an insuperable advantage because of the cheapness of their iron supply, the lower cost of their labor, the size of their plants, and the experience of their technicians.[49] By 1870 ocean-going steamships could be secured in these centers at from 20 to

[44] A.R.C.N., 1914, p. 199.

[45] Lynch Report, pp. 272–275.

[46] Lynch Report, pp. 272–275.

[47] Lynch Report, pp. 160–161.

[48] Lynch Report, pp. 160–161.

[49] Letter of Samuel Harlan, President of Harlan and Hollingsworth of Wilmington, builders of iron ships, Lynch Report, pp. 165–166.

35 per cent less than in the United States. American shipbuilders at this time widely used imported iron on which comparatively high duties were paid. Hence there was strong pressure for free materials, which, it was felt, would remove much of the differential.[50] At the end of the decade, therefore, it is clear that the industry was still an economic infant.

During the 'seventies the shipbuilding industry reached a considerably higher degree of maturity. Iron supplanted wood almost entirely as a material for large ocean-going steam vessels, although in the building of small craft the latter material remained a strong competitor. Several moderate-sized liners were built. Aided by its subsidy, the Pacific Mail Company, which had extended its service to China, ordered from the yard of John Roach at Chester, beginning in the years 1873–1874, a long series of "cities," headed by the 5080-ton *City of Peking*. William Cramp and Sons built in the years 1872–1873 four 3104-ton ships, the *Pennsylvania*, *Ohio*, *Illinois*, and *Indiana*, for a projected transatlantic line which was to run from Philadelphia. Other vessels were built for services from New York to Brazil, Mexico, Cuba, Venezuela, New Orleans, and other southern cities, and for the growing services from San Francisco to Oregon and Alaska.[51] There was also a considerable amount of building for the account of the Merchants and Miners Line and the other short-voyage coastwise lines of the Atlantic seaboard. The Cramp yard even secured a contract for a small Russian war vessel, the *Zabiaca*, which was finished in 1879. Most of these vessels did not exceed the moderate size of 3000 gross tons. In addition to this progress in the building of iron hulls, improvements were also made on engine design and construction. Indeed, the Pennsylvania Railroad, in placing its orders for the *Pennsylvania* and her sister ships, specified that a thorough survey of European designs and practice be made by Mr. Cramp.[52] As a result these vessels were given compound engines of the then modern Elder type.[53] By the end of the decade, in fact, the earlier crudities of American ship

[50] Statements of L. A. Smith of the Continental Iron Works, New York, Franklin W. Smith, Treasurer of the Atlantic Works, Boston, and Samuel Harlan, Lynch Report, pp. 31, 125, and 166, respectively.

[51] List of vessels built by John Roach, Harlan and Hollingsworth, and William Cramp and Sons, 1870–1882, Dingley Report, pp. 83–86.

[52] Cramp, "The Evolution of Screw Propulsion," pt. II (1910), pp. 54–55.

[53] Cramp, "The Evolution of Screw Propulsion," pt. II, pp. 54–55.

and engine building had been largely ironed out. The principal problems then became predominantly economic ones.

During the 'sixties and 'seventies the size of the individual establishment increased notably, and the number of yards building seagoing iron vessels was reduced to a handful, with the result that conditions of oligopoly began to appear. Foremost in the industry were three yards on the Delaware, those of John Roach & Son, Harlan & Hollingsworth Company, and William Cramp & Sons, which between 1870 and 1883 built, respectively, 146,693, 64,496, and 64,397 gross tons of shipping. John Roach, who had been associated with the Morgan Iron Works at New York, which he later owned, established his yard at Chester in 1872, and by the end of the decade was in a position to build as many as ten large ships at once.[54] The total number of men employed in the Chester yard and the New York shops was then about 3000, and the weekly payroll amounted to about $32,000.[55] The firm of Harlan & Hollingsworth of Wilmington began as an engine shop in the late 'thirties, and soon began the construction of small steamers for the Gulf trade.[56] It rapidly grew and specialized to some extent in small craft. It also built railroad cars. The Cramp firm, which was later to become the foremost American organization, was the only important yard to switch from wooden to iron construction. Prior to the Civil War it had built the largest wooden merchant ships constructed at Philadelphia, and had also contracted with iron masters for services in connection with the erection of iron vessels.[57] The firm did not begin the construction of iron ships on its own account, however, until 1866, when the steamship *William H. Aspinwall*, 202 tons, was built.[58] These were the primary builders at this time, and were the only firms which were well enough equipped to obtain substantial economies of scale. Although iron ships were also built by Pussey & Jones at Wilmington, Harrison Loring & Company and the Atlantic Works at Boston, and several minor establishments, the big firms on the Delaware dominated the industry.

The competitive position of the shipbuilders failed to show any

[54] John Roach, *Free Ship Policy* (1877), Columbia University Pamphlet Collection.

[55] Statement of John Roach, Dingley Report, p. 87.

[56] Cramp, "The Evolution of Screw Propulsion," pt. 1, p. 156.

[57] Statement of C. H. Cramp, Lynch Report, p. 157.

[58] Lytle, "The Construction of Iron Ships in the United States, 1834–1872," p. 218.

substantial improvement as a result of the growing maturity of the industry, and indeed even showed signs of deterioration. It was impossible for the builders to offset the relatively high wages prevailing in the protected American industry. The wages of shipyard workers, who were a skilled group, were chiefly governed by those prevailing in the protected iron, iron fabrication, and engineering industries, from which workers were chiefly drawn.[59] Expansion in these industries under the influence of the tariff and internal development tended to raise wages in such trades somewhat above those prevailing generally. At John Roach & Son's Chester yards the average weekly rates of pay in 1882 were \$13.54 for machinists, \$15.17 for pattern makers, \$13.38 for boiler makers, fitters, and riveters, \$14.75 for ship riveters, \$10.94 for ship fitters, and \$9.11 for drillers.[60] In general, highly skilled workers received about \$14 per week, moderately skilled workers about \$11 per week, and unskilled workers about \$7.50 per week. A comparison of wage levels for the same crafts then prevailing on the Clyde showed the cost of Scottish labor to be about 44 per cent less.[61] Since labor costs comprised between 40 and 50 per cent of the total cost of a ship this was a serious differential. The cost of iron, the other principal item, was also somewhat above the world level. Between 1876 and 1881 the average price per pound paid by John Roach fluctuated between 2⅛ and 3 5/16 cents for ship plate and between 2⅛ and 3¼ cents for angle iron.[62] Prices in England were between ¾ and ⅞ of a cent per pound less. The result was that, despite the increase in the use of labor-saving devices and other savings, the prices of steamships in the United States were from 25 to 35 per cent more than in Great Britain.[63] It is not surprising, therefore, that few vessels were built for the foreign trade and for foreign owners. Indeed, in the three large yards mentioned but 100,576 tons of the 275,586 tons built between 1870 and 1883 were for such accounts.[64] But for the mail subsidies, the amount of building for the foreign carrying trade would have been much less.

[59] Statement of C. H. Cramp, Farquhar Report, p. 126.
[60] Statement of John Roach, Dingley Report, p. 87.
[61] Statement of John Roach, Dingley Report, p. 87.
[62] Dingley Report, pp. 87–88.
[63] Report of the Committee, Dingley Report, p. 5.
[64] Statement of John Roach, Dingley Report, p. 88.

4

The introduction of steel in the 'eighties marked another important step in shipbuilding. Steel had been used for some two decades in experimental craft, but its high price prevented its general adoption. The invention of the Thomas basic process in 1879 removed this difficulty by making low-cost phosphoric ores available. Improvements in rolling removed the lack of uniformity and other technical drawbacks which had caused the rejection of steel in 1868.[65] In 1876 two steel dispatch ships for the British Admiralty met all tests satisfactorily and the "resurrection" of steel began.[66] The first steel steamship, the *Rotomahana*, 1777 gross tons, for the Union Steamship Company of New Zealand, came off the ways of the Denny yard at Dumbarton in 1879.[67] The first Cunard steel ship, the *Servia*, 7392 gross tons, was completed in 1881.[68] In England the shift to steel construction subsequently proceeded rapidly, being practically completed in a dozen years.

The advantages of steel were so great that shipbuilders could not neglect them. Not only was the saving in weight substantial, but in addition the ease with which steel could be shaped cold by powerful machinery reduced the cost of shipbuilding.[69] The prices of steamships consequently fell rapidly. The introduction of other innovations in hull and engine design together with the use of steel produced another revolution in shipbuilding which created great liners, large freighters, and powerful armored ships.

In the United States the new era in shipbuilding was ushered in with a substantial expansion in the industry. Of primary significance was the rise of naval construction, which provided an important backlog of business. Prior to 1883, naval construction in private yards in peace time had not been of any magnitude, and had not directly entered into the plans of the shipbuilders or the government. Ordinarily the larger vessels of the Navy had been built in the Portsmouth, Boston, New York, Philadelphia, and Norfolk navy yards. In war additional orders were placed with private yards. Construction had been spasmodic, depending

[65] Clapman, *Economic History of Modern Britain*, II, 62–63.
[66] Clapham, *Economic History of Modern Britain*, II, 62–63.
[67] Jackson, p. 149.
[68] Jackson, p. 150.
[69] Pollock, pp. 122–123.

on the political situation. Stores of materials were kept on hand in the navy yards, however, and several ships-of-the-line were normally maintained partly finished on the stocks. Hence it had only been in time of emergency that business of much value had been provided for the private yards.

The Navy began to undergo a transformation, however, in the early 'eighties. The old naval policy of maintaining a small number of cruisers for commerce raiding began to be questioned. The vulnerability of wooden steam frigates and sloops to shell fire was becoming more and more obvious, although it was not until 1875 that the last of these wooden vessels, the *Trenton*, was built. The numerous iron monitors were found to be slow, unseaworthy, and useless as a seagoing fleet. Hence in 1883 the first steel warships, the *Chicago*, *Boston*, *Atlanta* and *Dolphin*, were authorized by Congress.[70] Of these, the *Chicago* was the largest, displacing 4500 tons. Two more cruisers, the *Charleston* and *Newark*, and two gunboats, were authorized in 1885. Subsequently, between 1885 and 1889 thirty vessels totaling nearly 100,000 displacement tons, including the battleships *Maine* and *Texas* and the armored cruiser *New York*, were authorized.[71] Thus, beginning in the 'eighties, the United States Navy became an important customer of the shipbuilders.

These orders were stimulating. In order to build the ships it was necessary to secure improved tools and equipment, which could be readily done by borrowing because of the improved credit position of the industry. Hence large sums were spent to secure the necessary equipment, both for the shipyards and the steel mills, and as a result the industry was for the first time substantially modernized.[72] The Cramp yard alone spent over $350,000 on new equipment, including $50,000 for a hydraulic riveter and other hydraulic machines.[73] A similar expansion took place at the Chester yard, now the Delaware Shipbuilding Company. The Union Iron Works of San Francisco, which had been building mining machinery and engines for Pacific-coast steam schooners, set up ways for the building of ships as large as 5000 tons and secured elaborate machinery in England for the con-

[70] 22 U.S. Stat. 477 (March 3, 1883). [71] Sprout, p. 189.

[72] R. W. Meade, Rear Admiral U.S.N., "Professional Experience in Connection with the Naval Construction of the Last Ten Years, 1884–1894," *Trans. S.N.A. & M.E.*, II (1894), 2.

[73] Statement of C. H. Cramp, Farquhar Report, p. 129.

struction of the cruisers *Charleston* and *San Francisco*.[74] At Newport News the construction of a new modern yard for the building of warships and large commercial steamships was commenced in 1890.[75] New facilities for making large forgings and castings were also created. Prior to the naval orders the United States had had no equipment similar to that in use in the great works of Vickers and Sir Josiah Whitworth in England, Schneider-Creusot in France, and Krupp in Germany. Although Krupp had produced a forging of over fifty tons in 1873, the maximum size of forging which could be secured in the United States had been about seventeen tons, and the majority of the works had been able to produce pieces of but twelve tons.[76] Hence it had been necessary to import the heavier types of compressed iron forgings from Europe.[77]

The naval contracts induced the Bethlehem Steel Company, however, to contract with the Whitworth Company in 1886 to supply two complete sets of heavy hydraulic forging equipment, technicians, and full information, and to remodel its Bethlehem plant.[78] Plans and equipment for the manufacture of armor plate were also secured from the firm of Schneider-Creusot.[79] Hence by 1888 it was possible to secure in the United States heavy forgings and castings, armor plate, and heavy guns.[80] An important factor which stimulated this development was the provision in the Navy Act of 1886 requiring shipbuilders to use only domestic materials in warship construction.[81]

The stimulating effect of naval construction continued with accelerating intensity after 1890. The government was beginning to accept the philosophy of sea power which was set forth in Captain A. T. Mahan's great work, *The Influence of Sea Power upon History, 1660–1783*.[82] This philosophy embodied the prin-

[74] Statement of Irving Scott, General Manager, Farquhar Report, pp. 266–267.

[75] Farquhar Report, p. 124.

[76] R. Davenport, "The Production in the United States of Heavy Steel Engine, Gun, and Armor Plate Forgings," *Trans. S.N.A. & M.E.*, I (1893), 70–72.

[77] T. D. Wilson, Chief Constructor, U.S.N., "The Steel Ships of the United States Navy," *Trans. S.N.A. & M.E.*, I (1893), 116.

[78] Davenport, p. 72.

[79] Davenport, p. 74.

[80] Davenport, p. 73.

[81] Sprout, pp. 193, 205; 24 U.S. Stat. 215–216 (Aug. 4, 1886).

[82] Published in Boston, 1890. This work exercised a profound influence on naval thought and policy in the United States, Great Britain, and Germany.

ciple that to be successful it was necessary for an industrial state to keep its lines of seaborne trade open in time of war, which could be done only by means of a fleet of capital ships strong enough to prevent a blockade, and to take command of all or at least part of the sea.[83] This strategically-sound principle required the fostering of the shipbuilding industry and the building of the first American battle fleet. Also embodied in Mahan's thought was the need of developing a national merchant marine and overseas colonies to make the lines of communication still more secure.

The stimulating effect of this philosophy on American naval policy resulted in extensive and fairly regular construction of heavy warships. Three battleships of 10,000 tons displacement and seventeen-knot speed, the *Indiana*, *Massachusetts*, and *Oregon*, were authorized in the Naval Act of 1890.[84] In 1893 another battleship, the *Iowa*, and an armored cruiser, the *Brooklyn*, were begun. Battleships cost at this time about $5,000,000 each. Subsequently a year rarely passed without the keel-laying of one or more first-class battleships and numerous other craft. With the election of Theodore Roosevelt the tempo was increased. Between 1901 and 1905 ten battleships, ranging between 13,000 and 16,000 tons in displacement and between $5,800,000 and $7,500,000 in price, were authorized.[85] Indeed, by 1905 the Navy had twenty-eight battleships and twelve armored cruisers. In 1906 the first dreadnaught, the 20,000-ton *Delaware*, was authorized, and she was followed by others, the cost of which was about $8,500,000 each.[86] As the World War approached, construction was at the rate of one or two dreadnaughts a year. Meanwhile these ships had risen in size to 32,000 tons displacement and in cost to between $14,000,000 and $16,000,000 each. Mounting 14-inch guns and steaming at twenty-one knots, they were the most complex examples of the shipbuilder's art. To construct such ships it was necessary to develop large, well-equipped shipyards, engine works, steel plants, and specialty works, to train a corps of highly skilled naval architects, engineers, draftsmen, and constructors, and to create a large skilled labor supply. Naval construction, therefore, provided the stimulus necessary to develop fully the American shipbuilding industry. In turn it became a most important part of the economy of national defense.

[83] A. T. Mahan, 1917 ed., chap. i.
[84] Sprout, p. 213.
[85] Sprout, p. 260.
[86] Sprout, p. 263.

As a result of this continued active business the shipbuilding industry increased rapidly in size and efficiency. On the Atlantic seaboard arose four large shipyards in which most of the naval and ocean-going merchant-ship construction was concentrated. Of these the two largest were the Cramp yard and the plant of the Newport News Shipbuilding and Drydock Company, which after the turn of the century employed between 5000 and 7000 men each.[87] Two slightly smaller yards were those of the New York Shipbuilding Company at Camden, New Jersey, and the Fore River Ship and Engine Company at Quincy, Massachusetts, which employed between 3000 and 5000 men.[88] There were also a number of other establishments located at Bath,[89] Boston, Wilmington, and San Francisco, which employed between 1000 and 2000 men each. Whereas it had been estimated that a capital investment of about $50,000 would provide a plant sufficient for the construction of a 3000-ton iron freighter in 1886,[90] the investment in each of the large yards approached $1,000,000 after the turn of the century, so much had mechanization increased. Every effort was made to reduce labor costs by means of mechanization. With a few exceptions the equipment of the larger yards then compared favorably with that of English establishments.[91] Powerful traveling cranes, electrical and hydraulic tools, powerful machines for cutting, punching, and bending, and precision lathes and milling machines became standard equipment. Pneumatic riveters were developed, beginning about 1896, to increase the speed and accuracy of erection.[92] Although some American tools were sold in England, it was still necessary to import some of this equipment. Efforts were made, following European practice, to establish routes for material through the shops, and to organize production schedules. Thus the shipbuilding industry became a large-scale business in which mechanization and scientific management were of the utmost importance.

[87] Tables showing tonnage under construction, number of men employed, and capital invested in American shipyards. See A.R.C.N., 1901–1914.

[88] A.R.C.N., 1901–1914.

[89] "The Steel Shipbuilding Plant of the Bath Iron Works," M.B.I.L.S., 1896, pp. 103–133.

[90] A.R.C.N., 1886, p. 35.

[91] Statement of E. S. Cramp, R.M.M.C., I, 424. For a qualification see statement of G. W. Dickie, Naval Architect of Union Works, R.M.M.C., II, 1415.

[92] W. I. Babcock, General Manager, Chicago Shipbuilding Company, "Portable Pneumatic Riveters in Shipbuilding," *Trans. I.N.A.*, XLI (1899), 121–122.

The shipbuilding industry also began to rise on the Great Lakes near the centers of the iron and steel industry. Here, indeed, it reached its greatest effectiveness because of the favorable material transport relations and of the standardization of design. The primary factor in this development was the rise of the iron-ore and grain trades from Lake Superior to the East through the Sault Ste. Marie Canal, following the Civil War, for which trade the small wooden schooners and steamboats formerly used proved to be inadequate. The first iron steamer, the 2164-gross-ton screw vessel *Onoko*, which was equipped with a compound engine, was built at Cleveland in 1881.[93] The construction of steel vessels was begun in 1886 with the building of three ships totaling 6459 gross tons.[94] The industry expanded so rapidly that the output of steel steamers reached about 48,000 gross tons in 1891, and 152,000 gross tons in 1901.[95] Total construction on the Great Lakes during the decade amounted to 600,000 gross tons, or 60 per cent of the 1,005,000 gross tons of commercial vessels built in the United States.[96] Yards were established at Cleveland, which built 249,341 gross tons during the decade, Port Huron, Detroit, Chicago, Marquette, Buffalo, Toledo, and several other places.[97] By 1904 the dominating concern in this business was the American Shipbuilding Company, which had plants at Buffalo, Cleveland, Lorain, Wyandotte, Detroit, Bay City, Duluth, and Chicago.[98] In these works some 175 steamers with a carrying capacity of some 1,000,000 tons deadweight had been built within five years. The shipyards on the Lakes specialized in large long shallow-draft freighters capable of carrying from 6000 to 10,000 tons deadweight, which because of their long parallel body amidships and simple design could be cheaply built in large numbers. By specialization in this type of work and the adaptation of the plant to it considerable economies were achieved.[99]

[93] J. F. Pankhurst, "The Development of Shipbuilding on the Great Lakes," *Trans. S.N.A. & M.E.*, I (1893), 257.
[94] Pankhurst, "The Development of Shipbuilding on the Great Lakes," *Trans. S.N.A. & M.E.*, I (1893), 257–259.
[95] A.R.C.N., 1901, pp. 45–56.
[96] A.R.C.N., 1901, pp. 45–46.
[97] A.R.C.N., 1901, pp. 45–46.
[98] Statement of W. L. Brown, President, R.M.M.C., II, 705–706.
[99] Statement of Lewis Nixon, shipbuilder and naval architect, R.M.M.C., I, 75.

In this business the American yards had a considerable advantage over those of Canada, which were less favorably situated with relation to the material supply. Difficulty in getting large vessels to sea prevented the development of the building of deep-sea vessels, although some were occasionally laid down. Two large freighters, however, the *Minnewaska* and *Minnetonka* were built by the American Shipbuilding Company and sent through the Welland and Canadian Canals in two pieces, which were joined together at Montreal.[100] Later, many Lake-built ships were to sail on salt water. For the time being, however, the Lake builders stood apart from the seaboard industry as a result of their comparative isolation, relatively protected market, and specialized design.

The industry of building iron and steel merchant steamships in the seaboard yards, in contrast with that of the Great Lakes, languished despite the financial assistance of the naval contracts. During the decade from 1891 to 1900 the average yearly output was but 29,274 gross tons, compared with an average of 979,343 gross tons in Great Britain, 99,786 gross tons in Germany, and 20,440 gross tons in France.[101] During the following decade, however, the average output of American seaboard yards rose to 86,306 gross tons, reflecting the increase in coastwise shipping activities.[102] The majority of the seagoing tonnage built consisted of moderate-sized freighters and liners for the coastwise traffic. Few notable vessels were built, with the exception of the great transatlantic liners *St. Louis* and *St. Paul*, 11,600 gross tons, which were built by the Cramp yard in 1894 and 1895 respectively. The builders of iron and steel ships therefore had plainly failed to establish themselves in a favorable competitive position by 1914, although the industry had passed through half a century of development, and was reasonably mature both technically and economically.

5

The inability of the shipbuilding industry to produce ships at the world price levels created one of the primary problems of navigation policy facing the government after the Civil War. If protection of the shipbuilding industry were continued, the un-

[100] R.M.M.C., II, 710.

[101] A.R.C.N., 1900, p. 25.

[102] A.R.C.N., 1910, p. 68.

protected shipping industry, which was already burdened with a rising unfavorable operating differential, would decline to close to the zero point. On the other hand, the adoption of a free-ship policy would have meant a decline of the shipbuilding industry on the seaboard to a very low level, and some decline on the Great Lakes, which could be reached by small British and German freighters. The decline of the shipyards would, however, imperil the economy of national defense, of which they were one of the principal pillars.

An examination of the differential in shipbuilding costs shows that it was based partly on fundamental economic conditions in the American economy, partly on monopolistic practices, and partly on the lack of a sufficient scale and regularity of operations to permit of specialization among the yards and full utilization of equipment. The basic difficulty was the differential in wage rates, which reflected the relative scarcity of labor in the United States in general compared with land and natural resources, and, in particular, the shortage of skilled iron workers. American wage levels in the shipbuilding industry were primarily governed by the rates in engineering work, locomotive construction, structural steel erection, and similar activities which were considerably removed from international competition. The rates of pay in the navy yards, which were determined semi-annually by commissioners and were based on prevailing rates in various crafts, were also an important force determining wage levels. Unfortunately, a comparison of labor costs is difficult because in British yards payment was generally on a piece-work basis, the rate being set by negotiation with the craft unions, whereas in the United States payment was partly on a time basis and partly on a piece-work basis.[103] Furthermore, the relative efficiency of labor differed in the various types of work. One prominent naval architect found that the costs of erection in the yard in Great Britain and the United States were about equal because of the use of a large amount of machinery and efficient organization in the United States, but that in the handicraft types of work, which could not be so organized, costs of labor in the United States

[103] G. W. Dickie, Naval Architect of Union Iron Works, "Can the American Shipbuilder under Present Conditions Compete with the British and German Shipbuilders in the Construction of the Largest Class of Ocean Passenger and Freight Steamships," *Trans. S.N.A. & M.E.*, VIII (1900), 176.

were higher by 50 per cent.[104] This was particularly true of the work in the engine, boiler, and machine shops, where the machinery for each vessel was custom-made. Furthermore, the lack of sufficient heavy precision machinery in American yards made it necessary to erect the engines in the shops and fit the parts, whereas in Great Britain parts were generally made to gauge and kept in stock, and the engines were quickly assembled in the ship when ordered.[105] The rise of warship construction in the 'nineties considerably increased the size of the unfavorable labor-cost differential because of the shortage of skilled labor which was created. Many workmen were induced to move from the Clyde and other British centers to the United States at this time. By 1900 it may be estimated that American labor-cost levels ranged between 50 and 100 per cent above those prevailing in Great Britain, the exact amount depending in each case on the yards compared and the type of ship.[106]

The conditions creating the differential in material costs were considerably more complex. After the Civil War the American iron industry was still at a disadvantage in comparison with that of Great Britain because of its poor transport relations, high labor costs, and small scale of operations. Hence, although American iron was believed to be stronger than the foreign product, its high cost greatly retarded shipbuilding. By the end of the century, however, conditions were greatly changed, for the opening of the Minnesota iron ranges, the development of economical Lake shipping and railroad transportation, and the expansion of the iron and steel industry with the growth of demand in the protected domestic market had produced a powerful, well-organized large-scale industry which was certainly no longer an infant. Indeed, in 1901 a huge combine, the United States Steel Corporation, was formed. It might have been expected, therefore, that, since the industry was then achieving substantial economies of scale, was using rich natural resources, and was exporting steel products on a considerable scale, the price levels of ship steel might have been somewhat close to the foreign level.

[104] Dickie, pp. 176–177.

[105] Dickie, p. 178.

[106] Conclusion of the Merchant Marine Commission. See R.M.M.C., vol. 1, p. vii. See also the statements of E. S. Cramp, vice president of William Cramp and Sons and Calvin Orcutt, President, Newport News S. B. and D. D. Co., R.M.M.C., vol. 1, pp. 39, 424.

Actually, however, such was not the case, except temporarily during price wars, until about 1910, when for the first time the American price fell substantially below the European one. In 1897 and 1898 the price of ship plate in the United States had actually been somewhat below British prices because of price cutting, the figure going as low as $22 per ton f.o.b. Pittsburgh, which was from $3 to $5 per ton under the Middlesborough price in England.[107] This, however, was a rare situation, but as a result ship steel was extensively exported for the time being. Prices rose sharply after the outbreak of the Spanish War, however, and continued high following the establishment of the Steel Corporation. By May, 1905, the American price reached $35.84 per ton, where it remained stabilized for nearly two years, subsequently rising to $38.08.[108] The British price in May, 1905, was $28.53, but subsequently rose until by December, 1906, it nearly equaled the American price.[109] The latter was raised, however, and remained above the British price until March, 1909, when it again dropped sharply to a level below that prevailing in England.[110] Evidently under the influence of cartel control British prices rose sharply from $29.20 in 1909 to a high of $40.15 late in 1912, which level was maintained until August of the following year. Thus, during this period the relative positions were reversed, the American price at the end being about $8 per ton less than the British.[111] These fluctuations in prices were very disturbing to the shipbuilders.

It is evident that the shipbuilders in the United States, and later those in England also, were the victims of monopolistic practices. In the United States, since none of the yards were fully integrated as yet, it was necessary to depend on the steel makers, whose prices were established by the Steel Corporation, which by means of its economic power and the basing point system was able to enforce its own price levels on the entire industry. Furthermore, there was considerable dumping of surplus output abroad at various times, which dumping was made possible by the tariff. Shipbuilders were particularly incensed to find rival Clyde firms buying American steel at delivered prices considerably below the level prevailing in the United States.[112] The tariff

[107] Statement of E. S. Cramp, R.M.M.C., I, 423.
[108] A.R.C.N., 1914, pp. 75–76.
[109] A.R.C.N., 1914, pp. 75–76.
[110] A.R.C.N., 1914, pp. 75–76.
[111] A.R.C.N., 1914, pp. 75–76.
[112] Dickie, p. 179.

laws, however, effectively prevented extensive importation of either foreign or dumped American steel, although on occasion some American steel did reach the shipbuilders by way of Scotland. The tariff thus divided the market for steel into two parts, and the steel industry was able to pursue a policy of price leadership and price stabilization in the home market while selling at the world price abroad. It is probable that this policy permitted the average cost per unit of producing steel to be lowered by enabling the plants to earn additional sums toward overhead costs, but it is unlikely if any such savings were passed along to consumers. Serious problems of general economic policy were raised by this dumping, which was injurious to the poorly protected maritime industries.

Furthermore, the basing point system which was established in the industry as part of the system of price control to some extent injured the eastern seaboard yards, which were obliged to pay "phantom" freight from Pittsburgh at times, even when buying steel from seaboard mills. The development of shipbuilding in the South and on the Pacific Coast was also retarded because of the inability of the industry to secure the advantages of the low costs of production in the Birmingham region. As a result of these discriminations there was much antagonism toward the "steel trust," as the United States Steel Corporation was called, on the part of the shipbuilders. It may be concluded, therefore, that under different pricing policies, such as might have resulted from the more vigorous application of the anti-trust laws to the steel industry, the cost of steel to the shipbuilders might have been considerably reduced, and might even have been brought permanently below the foreign level.

The interests of the steel masters and shipbuilders thus clashed on the issue of pricing policies in the steel industry. The tariff on steel and other materials used in shipbuilding came under severe attack, for it not only prevented the importation of materials but also fostered the system of discriminating prices or dumping. There was constant pressure on the part of the shipbuilders for relief, although these interests were, in general, protectionist in outlook.

Hence a drive was made to secure a drawback on duties paid on imported iron and steel and other materials used in shipbuilding. The Lynch Committee recommended the establishment of

a drawback system except for iron, on which a bounty equal to the duty was to be paid.[113] As a result, in the Tariff Act of 1872 certain materials were admitted duty free for shipbuilding, but iron was excluded from the free list.[114] Such materials were to be employed in the construction of ships for the foreign trade, such vessels being limited to but two months of coastwise navigation each year. Owing to certain peculiarities in the law it was without practical effect, however. A drawback was also recommended by the Dingley Committee of 1882 to apply to ships employed in both the foreign and intercoastal trade, it being estimated that this would be equivalent to about $34 per gross ton for a 2131-ton steam freighter and about $15 per ton for a large square-rigged ship.[115] The free importation of timber and of iron and steel plate and angles was not secured, however, until 1890,[116] and that of all materials not until 1894.[117] These measures were of assistance primarily in the construction of liners for the foreign trade because of the limitation on the employment of vessels so constructed in the coastwise trade for more than two months each year. The danger of delay on such a coastwise voyage exposed the owner to the risk of paying the full duties on the materials in the ship. Operators of tramp ships, who desired to be free to move their vessels on any trade, were unwilling to build vessels of foreign materials. This time limit was extended to six months in the Tariff Act of 1909,[118] which was an important concession to operators employing vessels partly in the coastwise and partly in the foreign trade,[119] but by then American steel prices were below the British, and the measure had no effect.

These measures gave, on the whole, little relief. Better results would probably have been secured from an attack on the price structure of the domestic steel industry. The drawback policy was based upon the theory that the shipbuilding industry could be developed on a basis of foreign supplies. While this was certainly not impossible, shipbuilders pointed out that considerable inconvenience and expense would be encountered in ordering ma-

[113] Lynch Report, p. xv.
[114] 17 U.S. Stat. 238 (June 6, 1872); Zeiss, p. 20.
[115] Dingley Report, pp. 6–7.
[116] 26 U.S. Stat. 613 (Oct. 1, 1890).
[117] 28 U.S. Stat. 548 (Aug. 27, 1894); Zeiss, p. 36.
[118] 36 U.S. Stat. 88 (Aug. 5, 1909).
[119] Zeiss, p. 65.

terials from such a distance.[120] Indeed, the relationship between heavy industry and shipbuilding was close, both technically and physically. Delay in filling special orders requiring the use of special machinery or in the delivery of materials or engineering equipment for vessels was certain to be costly in such a complex, highly scheduled industry as shipbuilding. Furthermore, it was clearly unwise to rely on foreign supplies for the construction of warships. Had the costs of the steel and various engineering industries been extremely high, and their technical efficiencies low, it might have been desirable to import materials and equipment for both merchant-ship and war-vessel construction. Such, however, was not the case, and it appears probable that either price competition or a policy of discrimination in favor of the shipbuilders, such as was practiced by the German steel industry, would have been sufficient. During the early part of the twentieth century this problem was partly solved by the integration of the leading shipyards and steel producers.

Finally, it is apparent that in the latter part of the nineteenth century the shipbuilding industry was not organized on a sufficiently large scale to secure maximum economies of operation. Shipbuilding by then had become a highly capitalistic industry requiring the use of much expensive equipment on which the overhead charges were large. It was essential that this machinery be fully utilized if expenses were to be kept low. Considerable success was achieved in this respect by the British shipyards, which specialized in various types of ships, such as armored warships, large liners, freighters, torpedo boats, and small craft, and were thus able to adapt their plants to the type of work undertaken. In the United States, however, it was difficult to secure such specialization in the absence of unified control of the entire industry.[121] Hence many of the shipyards were employed in succession in building battleships, liners, cargo ships, and tugboats. Orders were received sporadically, and expensive equipment was subjected to a relatively high percentage of idleness. There was, indeed, some specialization, for on the seaboard some of the yards did not undertake the construction of warships or other large vessels requiring heavy equipment, but this specialization was

[120] Statement of John Roach, Dingley Report, p. 111; statement of Lewis Nixon, shipbuilder, R.M.M.C., I, 77.

[121] Statement of E. S. Cramp, R.M.M.C., I, 424.

rather elementary. Only in the Great Lakes yards, in fact, were the benefits of more or less continuous production of one type of vessel secured. Such economies might have been achieved by a carefully planned rationalization of the seaboard industry, but this would have required the abrogation of competition and the exercise by the state of some control over plant utilization, costs, prices, and profits. Neither the industry nor the government would have been willing to follow this path. This was unfortunate, for an increase in the scale of operations accompanied by specialization and some standardization would have permitted the achievement of substantial reductions, perhaps of the order of 10 per cent, in the cost of building steamships.

As a result of these difficulties shipowners found that they were required to pay prices for their ships substantially in excess of those prevailing in the world market. The amount of this differential varied with the type of ship, the amount of business on hand in the shipyards, and the fluctuations in material and labor costs, but it was at all times a major problem. When business was slack, both European and American shipyards were usually willing to take ships at a figure considerably below cost in order to get some income to apply to fixed charges, and, what was even more important, to keep the organization of skilled workmen together. On the other hand, if the plant was full, high prices were generally charged. The supply of shipbuilding capacity was, in fact, extremely inelastic. Hence, there were wide variations in the prices at which ships were constructed. In general, at the turn of the century, the cost of ships was between 25 per cent and 50 per cent more in the United States than in Great Britain and Germany, the important world shipbuilding centers. The Merchant Marine Commission estimated in 1905 that the difference was normally between 37 and 47 per cent of the foreign figure.[122] Comparisons of vessel prices are often unsatisfactory because of differences in size, form, speed, and equipment. About 1901, however, the Atlantic Transport Line took delivery of two groups of identical ships, and the prices of these vessels provide an excellent comparison. The first group consisted of four 13,000-gross-ton 16-knot cargo and passenger steamships, two of which were placed with the New York Shipbuilding Company of Camden at a price of $1,846,000 each, and the other two with Har-

[122] R.M.M.C., vol. 1, p. viii.

land & Wolff at Belfast, Ireland, at a price of $1,419,120.[123] The second group consisted of six 8000-gross-ton 12-knot freighters, four of which were placed in the United States at $729,000 each, and the other two at Belfast at $534,000 and $486,000 respectively.[124] This case shows differentials of about 30 per cent of the British figure for the large vessels, and between 36 and 50 per cent for the freighters. The differential was greatest in the case of steam tramp ships, which were built in large numbers in specialized English shipyards, whereas such vessels were only occasionally built in the United States. It was least in the case of armored warships, in the building of which the economies of scale were slight.[125] Thus it is evident that the excessive cost of construction in the United States was sufficient to deter shipowners from building many vessels there for use in the competitive foreign trades, unless stimulating action was taken by the government.

6

This unfavorable competitive position of the American builders of iron and steel steamships led to a notable controversy concerning the registry laws. We have already noted some of the aspects of this problem in considering the position of the owners of sailing ships. In the case of the owners of steam vessels the issue was earlier drawn and of greater importance, because after the Civil War it was impossible effectively to compete with foreign ships by using large wooden paddle steamships. The problem was also more complicated because the question of national defense was closely connected with the maintenance of protection to the builders of iron ships.

The need of a free-ship policy became evident soon after the Civil War. Indeed, the high cost of ships threatened to prevent the operation of American steamship lines in foreign trade and to hamper those in the coastwise trade. Testimony before the Lynch Committee clearly showed that the operators of American packet ships were prepared to transfer their business to the English flag if relief were not granted. One firm, Williams and Guion, had, indeed, already placed in operation in their transatlantic service six iron liners, which had cost but £23 per ton, complete.[126]

[123] A.R.C.N., 1901, pp. 23–24.
[124] A.R.C.N., 1901, pp. 23–24.
[125] R.M.M.C., I, 74–75, 94.
[126] Lynch Report, p. 33.

Nevertheless, the Committee refused to recommend a free-ship policy, claiming that it would destroy the industries of building wooden and iron ships, that it would not solve the shipping problem, and that it would injure the defensive power of the country.[127] In general the Committee was exceedingly partial to the shipbuilders, especially those engaged in the construction of wooden sailing ships. Its policy was one of thoroughgoing protection. "Every consideration, whether of interest or of national pride, impels us to build upon our own soil the ships which are to bear the flag of our country to all quarters of the globe." [128] It was not blind, however, to the difficulties of the shipowners, and recommended the granting of a moderate navigation bounty for their assistance.[129] It was also proposed that the shipbuilders who used domestic materials be paid a bounty equal to any drawback of duties which they might receive if such a drawback system were established. This was, in effect, an autarchist shipping policy. The conclusion of the Committee was significant because it was the first important pronouncement of policy following the war, and because it established a pattern of thought which has remained dominant down to the present day.

The registry policy so recommended proved to be exceedingly harmful to the merchant marine, chiefly because the accompanying drawback and subsidy provisions were not enacted into law. The policy can, indeed, be understood only in the light of the background. At the time the building-cost differential was not as large as it later became, and it was possible that it might have been greatly reduced if substantial economies of scale had been secured and if material prices had been reduced. The success of such a policy, however, depended on the establishment as a fostering force of a stable and ample subsidy policy. This the country was unwilling to accept at the time, and hence the American industry was not able to secure these reductions in cost. The Committee was correct, however, in its view that a free-ship policy was not in this case a complete solution of the problem and that additional protection was necessary. The government was particularly reliant on the private shipyards for the construction of a war fleet, and peacetime naval construction was too inadequate and sporadic to maintain the industry on an effi-

[127] Lynch Report, pp. xi–xiv.
[128] Lynch Report, p. xiv.
[129] Lynch Report, pp. xiv–xv.

cient basis. Hence some measure to support the shipyards was desirable. Had the entire Lynch plan been developed, it is possible that a considerable expansion in both shipping and shipbuilding would have occurred. The moderate subsidy which would probably have then sustained the shipowners might have been accepted by the public as an expenditure for defense and the improvement of communications. A policy of free ships coupled with a limited subsidy would probably have been best of all. The failure of the Lynch bill in the House, however, left the shipowners stranded without protection, the shipbuilders with little business, and the national defense impaired. The resulting policy was the worst of several alternatives.

In the ensuing years the vested and other interests supporting protection for the shipbuilding industry became stronger, and the advocates of free ships became weaker. The free-ship policy was generally supported by the Democratic Party, in which southern and agrarian interests dominated, not particularly because the party was interested in shipping but because it was a good counter argument to the Republican policy of subsidies.[130] American navigation policy in this respect became stranded between the policy of the Democrats, who argued for free ships but could not secure enough votes, and the policy of the Republicans, who asked for large subsidies, which likewise were distasteful to many Congressmen. The shipbuilders, of course, ardently battled against all attempts to abolish protection. They even fought against the admission to registry under the Act of 1852[131] of "whitewashed" tramps, as foreign ships which had been wrecked and repaired in the United States to the extent of three-fourths of their first cost, were called. Between 1884 and 1904 over 350 of these vessels received registers.[132] In 1906 even this free-ship measure, which had been in effect since 1852, was repealed.[133] Protection to shipbuilding was also supported by a number of shipowners. Those in the coastwise trade feared that the admission of foreign-built vessels would cause a decline in the market value of their fleets, lower freight rates, and cause losses to be incurred on their high-priced tonnage. Some of the subsidized operators in foreign trade, such as the Pacific Mail Line, feared a

[130] Zeiss, p. 17.
[131] 10 U.S. Stat. 149 (Dec. 23, 1852).
[132] R.M.M.C., I, 428–429.
[133] 34 U.S. Stat. 17 (Feb. 22, 1906); A.R.C.N., 1914, pp. 240–241.

complete abandonment of the subsidy policy if free ships were secured. Some owners honestly believed that the national interest required the use of ships built in domestic yards. Thus the shipbuilders, the majority of the vested interests in the coastwise trade, and the subsidized lines — a very substantial portion of the maritime community — became opposed to free ships, and only a few unsubsidized operators engaged in the foreign trade, who were yearly becoming fewer, were in favor of them. With the rise of nationalism the opposition to repeal increased.

Sentiment in favor of maritime autarchy increased during the last two decades of the nineteenth century and the early part of the twentieth century. The Russell Committee in 1881 reported that the cost differential was not over 10 or 15 per cent, that the building of iron ships was a natural industry in the country and would be conducted more efficiently as soon as new equipment, then being produced, was installed, and that its maintenance was essential for national defense.[134] The majority of the important Dingley Committee of 1882 took the same attitude. "No remedy can be effective or wise which does not look to the development of iron-ship building in the United States." [135] The minority, however, demanded free ships, free navigation, and free trade.[136] With the election of Harrison in 1888 and the rise of the protectionists to power, sentiment in favor of protection was further increased. The development of the new navy underlined the military value of shipyards. "Shipbuilding is a military art. Navigation is an expedient of war. In these respects, these trades differ from every other branch of industry." [137] Thus reads the Farquhar Report of 1890, which supported both protection for shipbuilders and subsidies. An interesting special measure was a law of 1892[138] authorizing the registration of two large British liners, the *City of New York* and *City of Paris*, which, together with two new liners built in the United States, formed the American Line, the only American subsidized transatlantic liner service. This measure was obviously a compromise, but it significantly indicated the extent to which the registry law impeded the de-

[134] *Report of the House Committee on Commerce on the Causes of the Decadence of the American Merchant Marine, Means for its Restoration, and the Extension of Foreign Commerce* (1881), House Rep. no. 342, 46 Cong., 3 Sess., pp. 4–5.

[135] Dingley Report, p. 6.

[136] Dingley Report, p. 23.

[137] Farquhar Report, p. 11.

[138] 27 U.S. Stat. 27 (May 10, 1892).

velopment of the merchant marine. The Merchant Marine Commission of 1905 likewise reported in favor of an autarchist policy,[139] although owners pointed out that "the shipbuilders will wait until doomsday before Americans will build ships and pay double the money for them." [140] Thus during this long period no serious break occurred in the policy of complete protection for the shipbuilders.

In 1912, however, a major change in policy was made. Liberal sentiment had been growing during the last years of the Taft administration and eliminated all chance of securing protection by means of a subsidy. Hence both the shipping interests and the state showed increased interest in free ships. The Commissioner of Navigation, Mr. E. T. Chamberlain, had been vigorously advocating such a policy for some time. A free-ship provision was nearly written into the last Gallinger subsidy bill of 1911, which failed.[141] Finally, in 1912, a free-ship amendment was introduced by Representative Alexander, and after much debate was attached to the Panama Canal Act, which was passed.[142] The relief was only partial, however, for only new foreign steamships (those not over five years old) could be documented, thus shutting American owners out of the large secondhand world tramp-ship market which was the chief source of supply for the rising merchant marines of Norway, Italy, and Japan. Furthermore, such ships were excluded from the protected coastwise trade, thus limiting their marketability and their usefulness on routes which were partly coastwise and partly foreign. Such vessels were, however, made eligible for mail subsidies — a desirable provision. Unfortunately, provisions for meeting the operating differential were inadequate, and owners were without confidence in the stability of American policy, with the result that no foreign-built ships were documented during the brief existence of this law.[143] This reform was, in fact, too late to revive the dying American shipping firms, too incomplete and too little coördinated with other aspects of policy. Had it occurred in 1865 and been combined with a well-chosen subsidy policy there might have been a different story.

It was superseded after the outbreak of the World War by the

139 R.M.M.C., vol. I, p. iii.
140 R.M.M.C., II, 1287.
141 Zeiss, p. 65.
142 Zeiss, p. 66.
143 A.R.C.N., 1916, p. 241.

Ship Registry Act of August, 1914, which allowed the documentation for foreign trade of all foreign-built ships without distinction.[144] This law had been requested by the numerous American firms owning ships operating under foreign flags, and resulted in the transfer of 513,306 gross tons of shipping in the first eleven and one half months of its existence. By June 30, 1918, the amount of shipping documented under this act was 739,843 gross tons, which was equal to about 70 per cent of the tonnage documented for foreign trade on June 30, 1914.[145] It was made evident, therefore, that the free-ship policy could produce substantial results if sufficient pressure was applied.

7

The experience of the United States in protecting the shipbuilding industry after it had developed an unfavorable differential in costs of substantial magnitude shows the weakness of such a policy unless accompanied by other strong measures. It was clearly a failure, both as a means of developing the marine transportation system, and as a measure to promote national defense.

Considered from the standpoint of promoting an efficient transportation system it is evident that it raised the costs of providing the necessary capital equipment to American owners by as much as 40 or 50 per cent above the level which would otherwise have prevailed. In the case of shipping employed in the extensive coastwise trade, including after 1900 that to Hawaii and other overseas possessions, this added cost was paid by shippers, and ultimately by consumers. Since in the short-voyage coastwise and intercoastal trades the railroads were important competitors, the general effect was greatly to diminish the role played by the coastwise shipping industry in comparison with what it should have been if economic resources were to be effectively used. In all cases the hinterlands tributary to seaports were narrowed. Thus coastwise shipping did not secure its proper share of the traffic, and the complete transportation system did not operate at optimum efficiency. The situation was greatly complicated, however, by the discriminatory rate structure prevailing on the railroads, which resulted in low rates wherever competition from shipping arose. In the overseas foreign trades the effect was greatly to increase the forces tending to drive unsubsidized Ameri-

[144] 38 U.S. Stat. 698; Zeiss, p. 83.

[145] Mer. M. Stat., 1937, p. 42.

can shipping out of business. In the case of subsidized tonnage the government was forced to pay a larger subsidy than otherwise would have been necessary, and the problems of administration and control were greatly increased. The result was a larger opposition to subsidies in general than might otherwise have arisen, instability in policy, and the expenditure of large sums, which, however, were inadequate to secure the desired end of the policy. The protection accorded to the shipbuilders was, therefore, not well calculated to develop the maritime transportation system.

From the purely economic standpoint it might have been desirable to protect the shipbuilding industry in this way had it appeared probable that, with the development of large-sized plants, elaborate equipment, and skilled personnel, the costs of construction would have fallen to levels equal to or below those prevailing in the principal foreign centers, and that sufficient business to produce these economies would normally have been forthcoming. There was reason to believe in the early 'eighties that the German shipyards were in such a position, and the growing emphasis in Imperial policy on domestic construction was probably in the long run not harmful to the German shipping system. But even in such cases it proved to be absolutely essential that substantial initial aid be given. It is doubtful, however, if the United States shipbuilding industry was in a similar position. Although substantial economies were actually secured with growth, nevertheless the wage differential, and sometimes also the material-cost differential, were obstacles which could not be overcome. Hence, unlike the German industry, that in the United States was not an economic infant which, when matured, could stand unprotected.

From the standpoint of national defense the policy was also ill-chosen. One primary objective of the government was to maintain sufficient plant, equipment, and skilled personnel to allow of the rapid construction and repair of first-class warships in time of war. Defense could have been better promoted, however, by means of a suitable and well-organized naval building program undertaken either in public or private shipyards, or in both. The theory that a sufficient amount of naval tonnage could be suddenly built in time vitally to affect the course of a conflict was of dubious validity after the decline of the wooden ship. Battle-

ships came to require four years to build, rather than from six to twelve months. Furthermore, any large-scale expansion in facilities was difficult to secure once the existing specialized resources were fully utilized. Thus naval power depended primarily on the size and quality of the fleet in service on the outbreak of war. Maximum efficiency and economy in its construction could be achieved only by planned building in well-adapted shipyards. It was not until the last decade of the century, however, that the United States naval program embodied the regular construction of steel armored ships. Meanwhile the government relied heavily on commercial shipyards to provide facilities for some emergency construction and for repairs. The actual policy followed was not well calculated to build up these facilities, however, for the general effect of the policy was to stifle the industry of building large ocean-going ships. Thus it may be concluded that the maintenance of a commercial shipbuilding industry through protection as an alternative to the maintenance of an adequate navy was strategically as well as economically unsound, especially if the measures failed to stimulate shipbuilding substantially.

The possession of a sufficient supply of merchant tonnage on the outbreak of war was certainly also of prime importance. The policy of protecting shipbuilding was clearly not calculated to achieve this end. A large amount of merchant ship tonnage could not have been provided by the shipyards within the ordinary time limit of military operations in the new age of metal vessels. Hence a sound defense policy required a free-ship law, with which a limited shipbuilding subsidy could have been combined, and the development of a sufficient amount of American-flag shipping by means of moderate operating subsidies and other devices. In contrast, the registry laws, which were maintained primarily for reasons of national defense, were largely responsible for the fact that the United States entered the World War with a totally inadequate supply of merchant shipping. Subsequent experience showed the difficulty of building such tonnage quickly under war conditions. Had the nation already possessed a substantial low-cost fleet it would have been possible to make replacements and enlarge it with only moderate difficulty, and without the danger of a breakdown of both military and general marine transportation services. It may be concluded, therefore, that the American policy prior to 1914, which assumed that shipbuilding capacity

was of more military value than ships in service, was poorly designed to provide shipping facilities in time of war.

8

Few major maritime nations followed entirely the American registry policy during the last half of the nineteenth century, although many provided aid to the shipbuilding industry through subsidies and naval contracts. The international business in new merchant ships was therefore active between 1860 and 1914, Great Britain being the principal exporter. In France, where shipbuilding cost levels were high, a free-ship policy was introduced in place of a restrictive registry policy in the Anglo–French Treaty of 1860.[146] Many steamships were subsequently purchased in Great Britain. Following the Franco–Prussian War, however, aid was extended to the shipbuilders by means of construction bounties, largely for military reasons. Franch in 1881, in fact, adopted a system of dual subsidies to the shipping and shipbuilding interests, somewhat similar to that now in use in the United States. The construction subsidy was designed to reduce the prices of French-built vessels paid by the owners to approximately the English levels, and was fixed at 60 *fr.* ($11.58) per gross ton for iron and steel ships.[147] An additional subsidy of 12 *fr.* ($2.32) per 100 kilos was also granted French builders of marine boilers and machinery.[148] The shipyards were further protected by a provision which allowed a navigation bounty on French-built ships double that on foreign-built ones. This system was continued until the World War, the tendency being to raise the construction bounties and increase the effectiveness of other protective measures. In 1893 the construction bounty was raised to 65 *fr.* ($12.54) per gross ton, and that on boilers and machinery to 15 *fr.* ($3.00) per 100 kilos.[149] In 1902 limits were placed on the total yearly output which would be subsidized and on the yearly expenditure, and the navigation bounty was limited to French-built ships only.[150] In 1906 the construction bounty was again raised to 145 *fr.* ($28.53) per gross ton for steel steamships.[151] These measures revived the French shipbuilding industry and, together with the navigation bounties, produced a French-

[146] Lefol, p. 14.
[147] Lefol, p. 18.
[148] Lefol, p. 19.
[149] Lefol, pp. 20–21.
[150] Lefol, p. 22.
[151] Lefol, p. 25.

built and French-owned merchant marine of moderate size. The bounties to the shipbuilders, however, were an unnecessary expense which seriously drained the treasury without establishing the industry on a sound competitive basis. Indeed, under the last law, that of 1906, the total amount paid out in construction bounties was 84,300,000 fr. compared with 46,550,000 fr. for navigation.[152] Under the earlier laws, however, the navigation bounty had exceeded that on construction. Many owners had preferred to buy vessels in Great Britain. It may be concluded that the construction bounties of France were comparatively ineffective, and that as discrimination against foreign-built shipping in the granting of French subsidies increased, the protection so accorded the builders became burdensome to the shipowners and the state.

The German mercantile marine was at first built upon the basis of British-built ships. Later, however, the stimulus provided by the granting of subsidies and the construction of the Imperial Navy developed the shipbuilding industry to such an extent that in the construction of liners and warships it was a rival of the English industry in technical efficiency and cost levels. The building of iron ships had begun in Germany in 1851 with the establishment of works at Bredow, which several years later became the Vulkan Company.[153] As in the United States, naval work was an important stimulating force. Prior to 1867 all of the heavy armed ships of the navy of the German Confederation had been built in England and France.[154] Measures were taken by the Reichstag in that year, however, requiring the building of war vessels at home, even at higher costs. Three cruisers were built in Germany shortly afterward, and thereafter purchases abroad ceased. The shipbuilding and engineering industries were greatly stimulated during the 'seventies by these naval orders, and greatly improved their plants and technical knowledge.[155] Indeed, beginning in 1877, German shipyards began the construction of vessels for foreign navies, notably those of Russia, China, Japan, Greece, Turkey, and Brazil.[156] German builders, however, secured little

[152] Lefol, p. 34.

[153] Aimé Dussol, *Les Grandes Compagnies de Navigation et les Chantiers de Constructions Maritimes en Allemagne*, 2 vols. (1912), II, 5.

[154] Dussol, II, 7.

[155] Dussol, II, 8.

[156] Dussol, II, 8–9.

business from German shipping lines, most of which, because of better prices, financial connections, and the advanced state of British shipbuilding technique, placed their orders abroad. Between 1881 and 1887 the North German Lloyd ordered seven fast liners from the firm of John Elder at Glasgow.[157] Only strong pressure from Von Stosch, the Minister of Marine, induced the Hamburger Packetfahrt to build two large steamers in Germany in 1882. Thus, at this time German shipping was dependent on British shipyards.

The subsidy law of 1885, which required that subsidized ships be constructed in domestic yards, went far, however, to develop German shipbuilding. Following the passage of this law a powerful shipbuilding industry arose. Six liners were built by the Vulkan works at Stettin for the North German Lloyd in the years 1885–1886. The first great luxury liner to be built in Germany, the *Auguste Victoria*, which was for the Hamburg–American line, was ordered from the Vulkan yard in 1888, and performed satisfactorily. Subsequently German shipbuilders launched many large express liners, as well as battleships and dreadnaughts. By the 'nineties it may be said that the industry was technically mature. Specialization was well developed, the principal builders of large liners and warships being Blohm & Voss at Hamburg, the Vulkan Company at Bremen, F. Schichau at Elbing, Pillau, and Danzig, and the Weser firm at Bremen.[158] A score or so of other builders specialized in various types of smaller merchant and war craft. The shipyards were equipped with a large amount of machinery, much of it electrically operated. Investments were made in floating docks and other costly equipment essential for efficient construction and repair work. To aid this development the rising German iron and steel industry installed equipment to produce suitable plates, forging, and armor. Furthermore, special prices were given the shipbuilders by the iron and steel industry, and especially low freight rates were provided by the state railways.[159] Thus, although the development of German shipping was not made dependent on the use of German-built ships, nevertheless the Imperial Government, by means of naval orders, contract subsidies, special freight rates, and other aids, developed its shipbuilding industry until when maturity was reached in the 'nineties it compared favorably with that of Great Britain. This develop-

[157] Dussol, II, 11. [158] Dussol, II, 14–15. [159] Dussol, II, 19–22.

ment was possible because of the favorable wage level, the rise of the domestic steel industry, and the creation of a large class of skilled technicians. The German industry, therefore, was an infant which was successfully nurtured by state aid.

Many other important maritime nations also gave subsidies in one form or another to the shipbuilding industry, although free-ship policies were usually also in effect. Italy, which lacked coal deposits and heavy industries, granted construction bounties, beginning in 1885 with a rate of sixty lire ($11.58) per gross ton on hulls, and other bounties on engines and boilers.[160] These bounties were altered from time to time, but remained substantial. Japan, whose shipbuilding industry was an economic infant, began giving construction bounties in 1896.[161] Much of Japan's tonnage had come from England under a free-ship policy, but protection was increased, beginning in 1899, by discrimination against foreign-built ships in the granting of subsidies. Since most Japanese-built vessels were small, the importation of vessels continued on a large scale. The protection given was very slight and mainly indirect in the form of mail contract or loan provisions in Holland, Norway, Sweden, and Denmark. These latter nations bought most of their tonnage in the international markets.

It may be seen, therefore, that although other nations were often willing to subsidize shipbuilding, few were ready to check the growth of their fleets by registry laws such as were in force in the United States. Free-ship policies generally prevailed from the time of the Civil War to 1914. Despite the large bounties which were given in many cases, Great Britain, and, at the close of the period, Germany, were the principal world building centers. Most of the powers giving shipbuilding bounties only satisfied a portion of their needs in the home yards, and this was done primarily for reasons of national defense. For this purpose the construction subsidy was generally a satisfactory instrument. Thus the United States not only pursued an uneconomical policy, but also handicapped her shipowners in competition with those of nearly all of the maritime nations.

[160] Saugstad Report, pp. 275–276.

[161] Saugstad Report, p. 340.

CHAPTER XV

GREYHOUNDS AND CONTRACT SERVICES: THE ESTABLISHMENT OF THE MODERN STEAMSHIP NETWORK, 1863–1914

I

THE ECONOMIC HISTORY of the steamship section of the American shipping industry between the Civil War and 1914 divides naturally into two parts. The first is the history of the operators engaged in the international carrying trades, in which keen competition was encountered from liners and tramp ships flying many foreign flags. Many of the owners of these foreign ships secured substantial aid from their governments in one way or another, and nearly all could operate at lower costs than the great majority of American shipowners. The second part is the history of the operators engaged in the protected coastwise carrying trades. It was in these that the American steam fleet was chiefly operated. The level of freight rates in these trades was, in general, adequate to maintain returns on the capital invested in steam vessels at a satisfactory level, and hence the industry developed normally, though slowly. There also were employed in these protected carrying trades many wooden sailing ships, the prices of which remained comparatively low compared with those of American-built steel steamships. In this chapter and the next we shall deal with the first part, the development of American steam shipping in the foreign carrying trades, and in Chapter XVII we shall examine the developments in the coastwise trades.

During this period a number of important changes occurred in the organization of the world shipping industry and in the economic conditions controlling its localization. First, there was developed the first world-wide shipping network, which consisted of lines of steam vessels connecting all of the principal world seaports. These lines were supplemented by the many tramp ships, which provided services of an irregular nature connecting ports not ordinarily served by liners, and carried bulk cargoes. These increased in volume with the rise of agricultural activity

in producing areas overseas and with the development of modern industry. The distinguishing feature of this system was that it was world-wide in a sense that the shipping network had never been before. Formerly, it is true, ships had sailed to all of the oceans of the world. The American East Indiamen had made speculative trading voyages to the Far East, trading both going and coming at the Cape of Good Hope, Mauritius, Bourbon, Africa, India, the Dutch East Indies settlements, and China. Boston "nor'westmen" had sailed to California, Oregon, Japan, and China. California clippers had made the round-the-world voyage touching at South American ports, California, China, and European ports. But prior to the Civil War the voyages to the Pacific and Indian Oceans were chiefly irregular small-scale speculative ventures. International trade with the regions bordering the shores of these distant oceans was as yet little developed, and many, such as the Northwest Coast, were but little settled. These conditions soon changed, however, as settlement developed and as commercial connections were established in the older Oriental countries. By 1914 the international division of labor was comparatively far advanced and was based on an extensive, dependable, regular, and efficient ocean transportation system.

The geographical structure of the new steamship network was determined by complex forces. In general, shipping became a more active localizing force than formerly. The principal powers of Europe developed or established important contract liner services radiating outward from Liverpool, London, Hamburg, Bremen, Havre, Marseilles, Naples, Trieste, and many other ports between the Mediterranean and the North Sea to all of the important economic centers of the world. The several hundred fast mail liners employed brought all of the ports touched into ready commercial contact with Europe. In addition, the tramp ships, most of which were owned in Europe, tended to gravitate to a considerable extent into the carrying trades inward to and outward from their home ports.[1] The opening of the Suez Canal in 1869 enormously improved the transportation relations of Europe with the Eastern Seas, as we have already seen. Through it streamed the splendid mail steamships of the various government

[1] See A. J. Sargent, *Seaways of Empire, Notes on the Geography of Transport*, 2nd ed. (1930).

contractors, other liners, and a motley array of freighters. Most of these vessels were British, for both the British contract liners and tramp freighters were in the strongest position. For instance, in 1879, of the 2,263,000 tons of shipping which passed, 1,752,400 tons were British.[2] The canal was, nevertheless, also the highway for French, Dutch, German, and Austrian mail ships and many other vessels. In this system the Americas remained more at the circumference than at the center. Most of the lines which touched North and South American ports radiated from Northwest Europe. Few radiated from New York, Boston, or Philadelphia to South America, the Orient, or the ports of the Indian Ocean. The principal services out of the latter ports were maintained by the wooden Yankee windjammers, a small number of struggling American contract lines, and foreign steam tramps. In the latter part of the nineteenth century American freight brokers frequently chartered numbers of these foreign steam tramps and established regular line service of a sort. The transportation services so maintained were, however, much poorer than those secured by Europe collectively as a result of the strong subsidy policies of the chief nations. To westward steam navigation the barrier of Cape Horn raised a formidable obstacle. Hence the United States remained during much of this period at some distance from the center of the new network, the extensions and ramifications of which extended far and wide. This position was partly due to geography and partly to the lack of an aggressive policy.

Second, ship operation became predominantly a large-scale corporate business because of technical and institutional changes and subsidy policies. The firms of the first part of the century were, as we have seen, small proprietorships and partnerships, the vessels of which rarely cost over $20,000 each. By the Civil War, however, the price of a first-class wooden sailing ship had risen to more than $100,000, and later it was to go higher. It had by then become necessary to secure capital for sailing ships in the United States from many sources, and the ownership of vessels was divided into as many as 64 or 128 parts. In Great Britain, under the Merchant Shipping Act of 1854,[3] the ownership of vessels was divided into 64 parts, but these could not be

[2] Clapham, *Economic History of Modern Britain*, II, 215.

[3] 17 & 18 Vict. c. 104 (Aug. 10, 1854).

further subdivided.[4] After 1862, however, corporate ownership became common in England, since the investment in a new ship rose to a half-million dollars or more. For instance, after the turn of the century an 8000-gross-ton freighter cost the owners about $350,000 in Great Britain, and about $450,000 in the United States.[5] The capital of the great lines was then in the millions of dollars. The early English steamship lines, with the exception of the Cunard Line, were established under special charters. The British Companies Act of 1862,[6] which provided for limited liability for any company organized by seven or more persons, however, made modern shipping possible.[7] Henceforth investors of all types could take shares in tramp vessels or shipping lines with no danger of losing more than their investment. Single ships could be owned by a company. The narrow limits formerly imposed on the shipping industry by the risks of the business were thus removed, and capital flowed into it from many sources in great volume. English business, as a whole, adopted the corporate form, as the advantages of larger capitals and limited liability came to be appreciated, economies of scale caused large enterprises to arise, and inertia was overcome.[8] In this movement, the British shipping industry was not backward. The Cunard Line became a limited company in 1878, and its shares were offered to the public in 1880. In the United States, France, and Germany the corporate form of organization was also widely adopted for the business of operating steam vessels. Henceforth all the advantages of large-scale operation, combination, agreements to restrain trade, interchange of stock, and other practices of large-scale business became available to shipowners.

2

The third and most outstanding development in the world shipping industry was the rise of the great shipping lines and of line operations generally under the combined stimulus of increasing traffic, the economies and advantages of large-scale organization, and the influence of government support. Where traffic was heavy and there was a demand for fast regular service,

[4] Fayle, *A Short History of the World's Shipping Industry*, pp. 260–261.
[5] R.M.M.C., vol. I, p. x.
[6] 25 & 26 Vict. c. 89 (Aug. 7, 1862).
[7] Fayle, p. 261.
[8] Clapham, *Economic History of Modern Britain*, II, 139.

line operations had been developed by the owners of sailing ships, notably in the North Atlantic trade, as we have seen, and later in the carrying trade to Australia from England. The growth of steam navigation, which enabled the margin of speed, size, and regularity of liners compared with tramps to be greatly increased, enormously enlarged the field for line operations. The use of the corporate form and of new techniques of management also contributed advantages. Consequently strong shipping lines soon appeared on the major sea routes.

The provision of regular high-grade service meant inevitably that large-scale enterprise would arise. To provide such service a costly fleet of suitable ships became necessary, and the overhead charges on such ships became an important item of expense. At least four ships were necessary to provide a weekly express service on the North Atlantic, and on longer routes larger fleets were required. To provide frequent freight sailings, large firms often found it necessary to use a score or more of ships. It became important to reduce the port time of these costly fleets as much as possible in order to increase earning capacity. Office staffs for the solicitation of passengers and freight, the quoting of rates, and the rapid collection and distribution of mixed cargoes became essential. In order to contact shippers and passengers and to ensure a steady supply of business it even became necessary to establish inland offices and agencies and build up elaborate organizations at all ports touched by the line. Advertising designed to differentiate the service of each line and to build up good will became an important element in the economic arsenal. It also became necessary to create shore staffs to handle the problems of repairing, outfitting, provisioning, and otherwise operating the ships efficiently and economically, and to rationalize many other activities. Such matters, which were formerly handled by the shipmaster, could no longer be cared for quickly and economically by him. To carry the overhead of such an organization a large volume of traffic consequently became necessary, and the economies of scale secured by the big firms therefore became substantial.[9]

Hence huge corporations owning several hundred steamships each developed, notably in Germany, Holland, Great Britain, and France. In Germany in 1914 six German firms owned 220 steel

[9] Fayle, p. 266.

liners capable of 12 knots or more and aggregating 1,745,000 gross tons, besides numerous smaller and slower craft.[10] In Holland eleven companies owned 210 ships totaling 983,000 gross tons, or 73 per cent of the 1,435,000 gross tons of steel steamers of 100 tons or more.[11] The fleet of the British Peninsular and Oriental Steam Navigation Company alone totaled 306 ships of 1,554,000 gross tons.[12] In comparison with such organizations the large firms of the sailing-ship period, such as that of Duncan Dunbar of London, who perhaps owned 40,000 tons in the 'sixties,[13] or that of William Gray of Salem and Boston, whose fleet, then considered large, probably never exceeded 10,000 gross tons during the first two decades of the nineteenth century, seem decidedly small. In steam navigation, therefore, big business arose.

Fourth, during this period liners became sharply differentiated according to size, characteristics, and speed. First, there were the transoceanic express liners designed to carry passengers, mail, and express cargo rapidly. These vessels increased in size and number on all of the major sea routes. Second, a number of intermediate liners, which were designed to carry comparatively more cargo than the express ships and were relatively slow, although passengers were carried, were developed for services on which the demand was insufficient to support express liners. Finally, cargo liners began to appear also on many routes. The advantages of regular service attracted much high-grade freight from tramps to such vessels, which were soon to be found everywhere. Usually such vessels were distinguished by a rate of speed ranging from 10 to 12 knots, which was higher than was commonly found in tramps. A well-rounded shipping line frequently employed vessels of all types to provide a coördinated service suited to the needs of its clientele. Normally some such combination of services was advantageous to a firm, for in this way the overhead charges of line organization could be spread more thinly. The success of many of the big foreign lines may be attributed to the rational use of tonnage of all types on extensive networks.

[10] E. T. Chamberlain, *Liner Predominance in Transoceanic Shipping* (U. S. Department of Commerce, 1926), p. 38.
[11] Chamberlain, *Liner Predominance*, p. 38.
[12] Chamberlain, *Liner Predominance*, p. 32.
[13] Fayle, p. 258.

3

Most spectacular was the rapid increase in the size of the express liners during this period. The race for prestige and differentiation in service in the valuable transatlantic liner trade led to a rapid improvement in design and construction. A similar, though less spectacular race also took place on other trunk routes.

Until the mid-'eighties this development centered in Great Britain, where the building of big Atlantic liners became a specialty. In the 'sixties the screw propeller and iron hull became standard. The conservative Cunard Line brought out in 1862 its last paddle ship, the clipper-bowed *Scotia*, 3871 gross tons, which made the Atlantic passage from New York to Liverpool in 8 days and 22 hours.[14] With the *China*, built in 1862, the *Cuba*, built in 1864, and the *Java*, built in 1865, this premier line turned to screw propulsion.[15] The 'seventies saw the appearance of the first of the "greyhounds," which were distinguished by their greater size and power, their greater ratio of length to beam, and their superior fittings and appointments. The first of these was the Inman liner *City of Brussels* of 1870, which measured 3090 gross tons, and 6900 displacement tons, had engines of 3020 horsepower, steamed at 14½ knots, and reduced the time of the Atlantic crossing to 7 days and 22 hours.[16] She was rivaled, however, by the new White Star Line's *Oceanic*, 3708 gross tons, which came off the ways at the famous Harland & Wolff yard at Belfast in the same year. This famous line, which had formerly owned and chartered American-built clippers and had been engaged in the Australian packet trade, entered the North Atlantic passenger service in this year under the leadership of T. H. Ismay.[17] The *Oceanic* measured 3808 gross tons and was 420 feet in length, the ratio of length to beam being 10.25 to 1.[18] She was the first important big ship to have compound engines and passenger quarters of a comparatively modern type.[19]

Subsequently rivalry became still more keen. The White Star

[14] Cornwall-Jones, p. 138.

[15] Cornwall-Jones, p. 139.

[16] C. H. Cramp, "The Evolution of the Atlantic Greyhound," *Trans. S.N.A. & M.E.*, 1 (1893), 3.

[17] E. K. Chatterton, *The Mercantile Marine* (1923), p. 190.

[18] C. H. Cramp, "The Evolution of the Atlantic Greyhound," pp. 140–141.

[19] Chatterton, p. 191.

Line built in the years 1871–1872 the *Adriatic* and *Celtic* of 3886 gross tons and 3880 indicated horsepower, the former of which reduced the passage to 7 days and 16 hours.[20] Edward Harland, the builder, received his knighthood for this achievement. The Inman Line built in 1873 the *City of Chester* and *City of Richmond* of about 4775 gross tons each on the Clyde, and in 1874 the *City of Berlin* of 5490 gross tons at Greenock. The latter lowered the time of the Atlantic crossing slightly. Then there came off the ways in 1874 the White Star liners *Germanic* and *Britannic*, of 5008 gross tons, and in 1879 the Cunard liner *Gallia*, 4809 gross tons, and the celebrated Guion liner *Arizona*, 5164 gross tons. The last-named ship lowered the westbound record out of Liverpool to 7 days and 4 hours, and maintained an average speed on her record run of 16.27 knots.[21] Thus by 1880 the competition of four English lines had produced a number of vessels of high speed and large size which were far superior to any vessels operated by rival owners.

During the 'eighties and 'nineties the size and power of liners continued to increase, and competition became international. The pioneer vessel of the new decade was the Guion liner *Alaska*, 9500 gross tons, 11,800 indicated horsepower, and 17.5 knots, which was completed in 1881 and lowered the westbound Atlantic record to 6 days and 18 hours.[22] Other important British vessels of the first half of the decade were the Inman liner *City of Rome*, 8144 gross tons, of 1881, the Cunard liner *Servia*, 7392 gross tons, also of 1881, the National liner *America*, 5228 gross tons, of 1883, and the Guion liner *Oregon*, 7375 gross tons and 18.5 knots, also of 1883.[23] These ships were all able to average more than 18 knots on an Atlantic crossing. The celebrated *Oregon* made the eastward passage from New York to Queenstown in 6 days and 10 hours in July, 1884.[24] The two most notable British ships of the decade were, however, the Cunard liners *Umbria* and *Etruria*, 8120 gross tons and 14,800 horsepower, which were built in the Fairfield yard in the years 1884–1885, and lowered the record to 6 days.[25] All of the fast ships of this period thus made

[20] C. H. Cramp, "The Evolution of the Atlantic Greyhound," pp. 3–4.
[21] C. H. Cramp, "The Evolution of the Atlantic Greyhound," p. 6.
[22] C. H. Cramp, "The Evolution of the Atlantic Greyhound," p. 7.
[23] C. H. Cramp, "The Evolution of the Atlantic Greyhound," pp. 6–8.
[24] For passages of the fast ships of this period see A.R.C.N., 1887, p. 243.
[25] C. H. Cramp, "The Evolution of the Atlantic Greyhound," pp. 9–10.

the run in under 7 days.[26] France entered this competition for the first time in the years 1886–1887, when four fast French-built liners of about 7000 gross tons each, the *Champagne*, *Bretagne*, *Bourgogne*, and *Gascogne* were launched.[27] The *Bourgogne* established a Havre–Sandy Hook record of 7 days, 3 hours. The German Norddeutsche Lloyd also entered competition with four English-built ships, the *Aller*, *Saale*, *Trave*, and *Lahn*, all of which came out in the years 1885–1887.[28] Then in 1889 was completed the first German-built greyhound, the Hamburg–Amerika Line's ship *Auguste Victoria*, which was built by the Vulkan yard at Stettin and resembled the English-built *Columbia* of the same line.[29] She was followed by the *Fuerst Bismarck*, 8874 gross tons, in 1891, which lowered the record from Southampton to New York to 6 days.[30] Germany and France thus appeared as strong competitors.

Competition now became exceedingly keen between the British, French, and German ships. The Inman Line brought out the 19–20 knot ships *City of New York* and *City of Paris* in the years 1888–1889. The White Star Line countered with the 9984-gross ton flyers *Teutonic* and *Majestic* in 1889, the latter of which made the Queenstown–New York run in 5 days and 17 hours.[31] The Cunard Line then built in 1892 the handsome liners *Lucania* and *Campania*, 12,950 gross tons and 22 knots speed.[32] Then in the years 1895–1896 the Cramp yard built the first American greyhounds, the *St. Louis* and *St. Paul*, 11,629 gross tons and 21 knots, which were built for the newly formed International Navigation Company. Other notable liners of the late 'nineties were the North German Lloyd's *Kaiser Wilhelm der Grosse*, 22.81 knots, which was completed in 1897,[33] the Hamburg–Amerika Line's famous *Deutschland*, 16,500 tons and 24 knots, which was completed at the Vulkan yard at Stettin in 1900, and was designed to carry 1100 passengers,[34] and the White Star

[26] A.R.C.N., 1887, p. 243.
[27] C. H. Cramp, "The Evolution of the Atlantic Greyhound," p. 11.
[28] Dussol, pt. 1, p. 41.
[29] Dussol, pt. 1, p. 15.
[30] C. H. Cramp, "The Evolution of the Atlantic Greyhound," pp. 9–10.
[31] Chatterton, *The Mercantile Marine*, p. 194.
[32] Chatterton, *The Mercantile Marine*, p. 195.
[33] Chatterton, *The Mercantile Marine*, p. 196.
[34] Dussol, pt. 1, p. 17.

Line's huge *Oceanic*, 17,274 gross tons and 20 knots. By the turn of the century express liners had become highly differentiated vessels, which were approaching 20,000 gross tons in size and 24 knots in speed, and which could carry over a thousand passengers, usually in two or three classes at differential rates. This rapid technical development, which was duplicated at a lesser rate in other trades, completely changed the form of organization of the shipping industry.

Notable improvements were also made in engineering in connection with the building of these vessels. The twin-screw design was introduced in the years 1888–1893 on such large ships as the *City of Paris*, *City of New York*, *St. Louis*, *St. Paul*, *Majestic*, *Teutonic*, *Lucania*, and *Campania*.[35] Auxiliary sail power was dropped at about the same time. The more economical triple-expansion engine was introduced in the late 'eighties, being installed in the Hamburg–Amerika Line's ship *Columbia*, completed in 1889, among others. The turbine, which embodied a notably different principle of power generation, had been developed experimentally on shore by Sir Charles A. Parsons as early as 1885, and was first successfully employed on board ship in the famous steam yacht *Turbinia*, 34 knots, which was built in 1894 at Wallsend-on-Tyne.[36] It was subsequently installed in H. M. torpedo boats *Viper* and *Cobra*, 370 tons and 37 knots, which were built in the years 1898–1899, in the fast cross-channel steamship *King Edward* in 1901, and in H. M. third-class cruiser *Amethyst* in 1903. The latter vessel was a duplicate of the *Topaze*, whose reciprocating engines required 22 pounds of steam per horsepower against 14 pounds for the turbine.[37] A special commission appointed by the Cunard Line recommended in 1904 that turbine drive be adopted, but the Company ordered the turbine liner *Carmania* even before the report was completed.[38] Turbines proved to be highly suitable for fast, powerful ships because, although costly, they were much lighter in weight and smoother in operation than reciprocating engines. Turbines of the Curtis type were built and installed on American warships

[35] Jackson, p. 150.

[36] E. M. Speakman, "Marine Steam Turbine Development and Design," *Trans. S.N.A. & M.E.*, XIII (1905), 247–248.

[37] Speakman, pp. 247–256; C. A. Parsons, "The Steam Turbine and its Application to the Propulsion of Vessels," *Trans. I.N.A.*, XLV (1903), 284–293.

[38] Speakman, p. 252.

and liners, beginning in the years 1902–1905.[39] These improvements gave steam vessels a level of efficiency and cruising ranges far in excess of those of earlier ships.

The technical development of express liners continued at an extremely rapid pace during the years from 1900 to 1914. The principal achievements were the increases made in size, speed, and luxury of appointments. Competition between the British and German lines became particularly keen. Two notable British ships which were built during these years were the Cunarders *Mauretania* and *Lusitania*, 31,000 gross tons and 25 knots, which came out in the years 1906–1907. These ships were followed in 1911 by the White Star liners *Titanic* and *Olympic*, 46,489 gross tons and 22.5 knots, and *Britannic*, 48,158 gross tons, which was finished after the outbreak of war. The last Cunard ship of this period was the *Aquitania*, 47,000 gross tons and 23 knots. The German lines countered by building a number of ships culminating in the *Imperator*, 52,022 gross tons, which was launched in Germany in 1912, and the *Vaterland*, of 52,282 gross tons, which was finished in 1914. By this time the operation of huge liners had become a matter of considerable importance to these rival maritime powers, which extended considerable support to the competing lines for this purpose.

There was also a notable technical development in the design of cargo liners. The era of big, fast, twin-screw freighters of 6000–8000 gross tons and 11–13 knots speed may be said to have begun in the 'nineties.[40] Typical of the new big ships then being brought out were the *Bovic*, 6583 gross tons and *Cevic*, 8301 gross tons, which were built by Harland & Wolff at Belfast in the years 1892–1893. Such ships were more economical to drive than smaller ones, and found ready employment in the expanding carrying trades, especially as cargo liners. Hence they superseded in many cases, on many routes, the older small general-cargo freighters of from 1000 to 4000 gross tons. There were also developed such specialized ships as tank vessels for the carriage of mineral oil, molasses, and other liquid cargoes, and refrigerator ships. The first refrigerator ship, the *Strathleven*, sailed from Sydney with frozen meat in 1879. The trend in con-

[39] C. G. Curtis, "Marine Applications of the Curtis Turbine," *Trans. S.N.A. & M.E.*, XIII (1905), 241–243.

[40] G. B. Hunter, "Large Atlantic Cargo Steamers," *Trans. I.N.A.*, XLI (1899), 347.

struction was thus clearly toward a specialization in design in the liner trades, each company developing specialized liners or freighters suited to its needs and designed to attract patronage to its own vessels.

The development of line service — express, intermediate, and cargo — between 1862 and 1914 was so rapid that, although the world tonnage employed in line operations was comparatively insignificant in 1862, it had by 1914 become the largest part of the world mercantile marine. It has been estimated that in 1914 the steel steamships employed in line services amounted to 58 per cent of the total number, 68 per cent of the gross tonnage, and 71 per cent of a year's transport capacity of the world steam fleet.[41] The liner fleet then consisted of 2758 vessels totaling 16,182,000 gross tons.[42] Of these, 1568 vessels of 10,771,000 gross tons were capable of speeds of 12 knots or more. The majority of these liners were operated with the assistance, great or small, direct or indirect, of some government. The American liner fleet totaled, however, but 176 vessels of 820,000 gross tons, of which only 65 vessels of 446,000 gross tons could make speeds in excess of 12 knots.[43] The bulk of the liner services were, therefore, controlled abroad. The development of foreign shipping lines and navigation policies was, therefore, of great importance. Hence, we shall now turn to a brief discussion of foreign shipping policies.

4

During the period under consideration the most important national merchant fleet was by a great margin the British. Therefore it is necessary to examine with some care the circumstances surrounding the rise of the British steam merchant marine. In general, British shipping reached its preëminent position because of its intrinsic competitive advantages rather than because of state aid.[44] It was, in fact, one of the few major national fleets which were not dependent on government aid in one form or another. The British industries of the building and operating of steamships were, in fact, infant industries which had rapidly matured as a result of the stimulus previously given by means of mail contracts, naval shipbuilding contracts, and other devices.

[41] Chamberlain, *Liner Predominance*, p. 2.
[42] Chamberlain, *Liner Predominance*, p. 21.
[43] Chamberlain, *Liner Predominance*, p. 29.
[44] Saugstad Report, p. 194.

The mail contracts had carried the contractors through the first period of development and of severe competition, and had enabled them to secure substantial economies from large-scale operations, establish a clientele, and organize their services. These advantages so secured were supplemented by others. Britain was becoming a great industrial and commercial nation, and possessed ample capital at low interest rates, which was essential for large-scale shipping development. On balance she was exporting capital and capital goods to the United States and other countries — a sure sign of an advantage in this respect.[45] The Companies Act of 1862, already mentioned, facilitated the formation of shipping enterprises. Furthermore, thanks to her progressive shipbuilding industry and leadership in engineering, she had access to the best source of vessel supply in the world. Labor was plentiful and efficient, although not as inexpensive as in some other countries. Furthermore, British commercial and financial interests developed on a world-wide scale and the resulting movement of cargoes tended, on the whole, to be in British ships, other things equal, for reasons of patriotism, convenience, and business relations. It may be concluded, therefore, that during this period conditions became basically favorable for the development of the British shipping industry, and that it was possible for the country to make an increasingly large investment in the industry without encountering rising costs.

The rapid increase in traffic on British ocean trade routes also stimulated expansion. Great Britain became a densely populated industrial state dependent on overseas sources of supply for foods and many raw materials, and on overseas markets for exports to supply the gold and foreign exchange essential for her needs. Hence there was a growing flow of both high- and low-grade cargoes in and out of the United Kingdom. Of great importance were the coal exports, which supplied a large proportion of the outbound cargo tonnage. British coal output rose from 84 million tons in 1861 to 185 million tons in 1891 despite the necessity of reaching greater depths in the mines[46] — a condition which Jevons feared would cause British coal operations and industrial development to receive a severe check.[47] The coal export trade,

[45] See Jenks, pp. 333–336.
[46] Clapham, *Economic History of Modern Britain*, II, 103.
[47] W. S. Jevons, *The Coal Question* (1865), 3rd ed., 1906.

which had always been important, rose rapidly, as British coal, which was superior for steam generation, was sent out to industries and coaling stations in many foreign ports. The amount so exported rose from 3–4 million tons a year in the early 'fifties to 24 million tons a year in the years 1884–1886.[48] Another important group of export cargoes consisted of iron and steel products, rails, and railroad equipment. Among the bulky import cargoes were grain, cotton, timber, other textile raw materials, and mineral products. Tramp ships operating out of British ports were thus certain to secure a large amount of business. Liners could, in addition, be sure of obtaining large shipments of fine manufactured articles. Great Britain thus became the hub of a vast amount of trade, and since the British competitive advantage was naturally greatest in carrying trades terminating in the British Isles this development inevitably stimulated the British shipping industries.

Under these circumstances, therefore, the British government was under little compulsion from 1860 until about 1890 to provide subsidies or other assistance in order to support and develop its shipping industry. Indeed, from the time of the establishment of the Inman Line in 1850 it became apparent that well-managed British lines could make their way practically unaided in many of the direct carrying trades of Great Britain. It is not surprising, therefore, that as a result of this fact, and the theory of economic liberalism then dominant, the British government reduced the scope of its financial assistance to shipowners. The early developmental work had, in fact, brought much fruit, and it was possible to reduce the subsidies without danger of deterioration in the merchant service!

Nevertheless, it was not the intention of the British government to abandon support of the shipping industry or of its contractors when such support was necessary. The original contract lines continued to receive government aid and to perform special services for the state. Several of these, in fact, became huge corporations, the continued existence of which was of the utmost importance to the state. New contractors operating additional connecting or radiating services also appeared. A number of important lines arose, however, without the aid of state funds, the most famous of these being the White Star and Inman Lines.

[48] Clapham, *Economic History of Modern Britain*, II, 226.

Furthermore, a comparatively new feature was the rise of many operators of cargo liners and tramp ships without any assistance at all. Britain thus had by 1914 a network of shipping services, some of which were or had been state supported and some of which had arisen in response to the demands of trade.

5

The government continued to support and assist in the development of its great regional contractors. The responsibility for the operation of the system, however, was transferred in 1860 from the Admiralty, where it had rested since 1837, to the Postmaster-General.[49] Foremost among these contractors was the Peninsular & Oriental Steam Navigation Company, the contract services of which were extended and improved under numerous agreements. The Australian service, which had been abandoned during the Crimean War, was restored soon afterward. By a contract of 1867, effective in 1868, the Company was made responsible for the entire Mediterranean and Far Eastern contract service, which consisted of weekly sailings from Southampton to Alexandria and back by way of Gibraltar and Malta; from Marseilles to Alexandria and back by way of Messina; and from Suez to Bombay and back, touching at Aden; and of fortnightly sailings on the routes from Suez to Madras and Calcutta; from Bombay to Singapore and Hongkong; from Hongkong to Shanghai; and from Shanghai to Yokohama.[50] The basic subsidy was fixed at £400,000 ($1,947,000) per year. Postal revenues at this time were in the vicinity of £235,000.[51] In addition, the Company held a contract of 1866 for a fortnightly service between Point de Galle, or Colombo, and Melbourne, Australia, for £134,672 ($655,380). So great was the importance which the government attached to the operations of this company that in the contract of 1867 it was provided that a limited guarantee of earnings of about 6 per cent on the capital be given. The basic fair return was set at £160,000, and the government agreed to make good deficiencies up to £100,000.[52] On the other hand, one moiety of any profits in excess of £213,000 was to be recaptured by the government. Provision was made for the auditing of the books by the government. This was one of the first instances in which

[49] Saugstad Report, p. 222.

[50] Saugstad Report, pp. 223–224.

[51] Saugstad Report, pp. 223–224.

[52] Saugstad Report, pp. 223–224.

a government attempted to do what later proved to be essential — namely, to put a contract service on a public-utility basis. If properly worked out such a system might have been most satisfactory in the long run to both parties, but disputes over depreciation and other expense items led to the substitution in 1870 of a fixed-sum payment of £450,000 ($2,190,000) per year.

The Company was never without substantial contracts during the remainder of the period prior to the World War. In 1874 the payment for the Mediterranean and Oriental services was reduced from £450,000 to £430,000, and the Bombay packets were required to transit the Canal. In 1879 the subsidy for these routes was further reduced to £370,000 ($2,093,000 per year) and the western terminal was established at Brindisi rather than at Southampton.[53] The payment for the fortnightly Australian service was also fixed in 1879 at £85,000 ($413,650) per year — a reduction of a third. This service was divided, however, with a new line, that of the Orient Steam Navigation Company, which received a like sum. The Company again received new contracts for the Mediterranean and Oriental services and the Australian service in 1887 and 1888 respectively, the rate for the former being reduced to £265,000, or $1,290,000, and for the latter being maintained at £85,000.[54] In 1897 the contracts were again renewed, the agreement providing for a combined subsidy for the two services of the Peninsular & Oriental Company of £353,000 ($1,720,000) per annum.[55] Another general contract was signed in 1907 providing for annual payments of £305,000 ($1,484,000), and this was made perpetual, subject to two years' notice by either party.[56] Minor adjustments in the rate of pay were made, however, from time to time. Under these contracts the Peninsular & Oriental Company, sure of its position and fortified by the prestige of its mail ships, reached an unprecedented size. The combined fleet of this Company and its principal subsidiaries, the Khedivial Mail Line, the British India Line, the New Zealand Shipping Company, the Union Steamship Company of New Zealand, and the Federal Steam Navigation Company, some of which did not receive subsidies on certain routes, amounted in 1914 to 306 ships of 1,554,000 gross tons, of which 189 of

[53] Saugstad Report, pp. 224–225.
[54] Saugstad Report, pp. 224–225.
[55] Saugstad Report, p. 226.
[56] Saugstad Report, p. 228.

1,076,000 gross tons were capable of 12 knots or over[57] — a substantial portion of the 19,751,000 gross tons of steel steam shipping under the British flag. In general this company operated the largest and finest British liners sailing to the East.

It has been necessary to give marked attention to the affairs of the Peninsular & Oriental Company because this case provides one of the best examples of European navigation policy during the last century. Perhaps the most notable feature was the continuity of the relationship with the government. Although several attempts were made to have a showdown to determine whether or not other contractors could perform the service more economically, it proved to be impossible for the government to dispense with the services of the Company, for its operations had become a part of the economy of its territory. In 1858 the rival European & Australian Steam Navigation Company, which had indeed just secured the contract for the Australian service, failed miserably. Only the Orient Line was able to secure substantial contracts in the Peninsular & Oriental's sphere of influence. Thus the Company became, in effect, an important public agency.

Competitive bidding proved to be an unsatisfactory procedure. Consequently negotiation was the actual method on which the state was forced to rely, although the formalities of bidding were usually required. The usual problems of insuring enterprising management and efficiency and of preventing excessive earnings which now confront governments dealing with quasi-monopolistic utilities therefore arose, and were not fully solved. It was proposed that relatively short-term contracts of about seven years be used as a club to permit of more or less continual adjustment of the rate of pay, but this device proved to be unsatisfactory to both the contractors and the government because of the need of long-range planning. Most of the contracts were for periods of between 10 and 12 years, but in 1907 the permanence of the relationship was finally recognized, as we have seen. Control was mainly secured by means of more or less continual oversight by the Post Office and Admiralty.

Not all of the subsidy was a net advantage to the contractor, for it had to provide a regular, rapid, and inflexible service under heavy penalties for nonfulfillment. These were rigorous conditions which other owners did not have to meet. Bonds of from

[57] Chamberlain, *Liner Predominance*, p. 32.

£35,000 to £60,000 were required, and penalties running as high as £500 per day for delays in sailing were imposed.[58] Hours of departure and maximum passage times were normally specified, and the government did not hesitate to require of the use of more powerful vessels when this appeared necessary. The speeds required, which had been 10 knots on the Atlantic and Mediterranean portions of the service and 9½ knots east of Suez in 1867, rose to 13½ knots and 12–12½ knots respectively in 1887, and to 14–16 knots on both services in 1897.[59]

Under these contracts the British government was able to secure frequent, fast, through mail and express service from Brindisi to the Far East and India. The time required for the transit from London to Bombay fell from 422 hours in 1874 to 270 hours in 1907, and to Shanghai from 965 hours to 678 hours.[60] The services were maintained with great regularity despite the problem of supplying high-powered mail steamers with coal at distant stations. The payments, which were generally at the rate of 4–5 shillings per sea mile, thus enabled the British to secure a higher grade and more regular service than would otherwise have been possible, increased British prestige in the East, and preserved to British liners the primary position in competition with subsidized French and German ships. No estimate of the advantages and disadvantages of such a system can be made, but clearly the political and indirect economic advantages were likely to be considerable. Thus by 1914 the little service of 1837 had grown into a giant regional system.

6

In a like manner mail contract support on a substantial scale was continued in the cases of the other original contractors. The Royal Mail Steam Packet Company developed its services covering the West Indies and the east coast of South America under a series of contracts. Under a contract of 1852 the Company had undertaken to provide a comprehensive service from Southampton to the West Indies and Central America and to the east coast of South America as far south as the River Plate for the sum of £270,000, the total yearly contract mileage being 547,296, and the minimum number of vessels specified fifteen.[61] At vari-

[58] Saugstad Report, p. 229.
[59] Saugstad Report, pp. 224–226.
[60] Saugstad Report, pp. 225, 228.
[61] Dingley Report, pp. 116–130.

ous times the service was accelerated and the quality of the equipment improved. In the contract of 1857 the Company was required to build three iron mail steamships of 3000 gross tons or more. In 1868 the Company was maintaining a 14-day fortnightly service from Southampton to St. Thomas, whence fortnightly services to St. Kitts, Antigua, Guadeloupe, Dominica, Martinique, St. Lucia, Barbados, and Demerara in one direction, to Porto Rico, Havana, Vera Cruz and Tampico in another, and to Haiti, Jamaica, and Colon in another were maintained.[62] From Colon and St. Lucia other connecting services were also maintained. A direct monthly service requiring 36 days from Southampton to Lisbon, St. Vincent, Pernambuco, Bahia, Rio de Janeiro, Montevideo, and Buenos Aires was also in operation. The entire system embraced an annual run of 530,000 miles, and the speed requirements varied between 9½ and 10½ knots.[63] The subsidy, under a contract of 1864, was then £172,914 ($841,485) per year. By this time the Company was securing considerable prosperity, although not all of its services were profitable, and the question of its relation to the government came to the fore. In 1864, a year of prosperity, the actual revenue, exclusive of the subsidy, covered 90 per cent of the expenses, according to the government auditor.[64] After the conclusion of the American Civil War and the appearance of subsidized French liners this proportion fell, however, to about 70 per cent. The subsidy was, therefore, shown to be essential, and was extended by negotiation, although, to protect itself, the state included a provision for the recapture of a half of all profits in excess of 8 per cent on the capital, which was stated to be £900,000. The Company in 1867 was operating 19 ships of a size and power equal to those of the P. & O. Company. In 1874 it bid in the contract for the services for £84,750 — a reduction of a half.[65] In 1895 this pay was again reduced to £80,000. Thus by means of contracts which slowly diminished in amount a strong service under the British flag was maintained in this part of the world. The Royal Mail Company and its affiliates became, by the end of the century, one of the largest shipping organizations in the world.

Closely associated with the Royal Mail Company in this part

[62] Dingley Report, pp. 214–215.
[63] Dingley Report, pp. 214–215.
[64] Dingley Report, p. 211.
[65] Saugstad Report, p. 248.

of the world was the Pacific Steam Navigation Company, which, it will be recalled, began contract operations on the west coast of South America in 1845. In 1865 a policy of expansion enabled the Company to operate ships monthly directly from England to the River Plate, Falkland Islands, and Valparaiso by way of the Straits of Magellan. Service was begun in 1868 with the *Pacific*, 1630 tons and 450 horsepower, thus providing a fast, direct, cargo service to this part of the world for the first time.[66] The Company then had no contract for its services, but received considerable revenue on a poundage basis until 1900, when a mail contract was concluded for £32,500 ($158,000) per year covering frequent services from England to points as far north in the Pacific as Guatemala. This was one of the few primary regional lines which was largely developed without the aid of heavy mail contracts.

7

In the case of the liner services to the United States, which were the premier services of the British merchant marine, it was possible slowly to taper off mail contract assistance as the leading British lines fully matured. No substantial reversal of policy was essential until German rivalry caused a reversion to a policy of strong subsidies. The Cunard contract of 1850, which provided for a payment of £173,340 ($843,600) per year for the transatlantic service, was renewed in 1858 at the request of the Company, although the British Postmaster-General felt that such renewal was unnecessary from the standpoint of the postal service.[67] The American lines by this time had ceased to be serious competitors, and there was, perhaps, little reason for giving aid to a favored contractor, since the British lines were definitely dominant in this trade. There was a brief threat to the Cunard Line's position when a contract was signed in 1860 with a rival line, which was to carry the mails to Canada and the United States by way of Newfoundland, but this organization failed to perform its contract because of the loss of one ship and the breakdown of two others, with the result that the agreement was canceled.[68] Until 1868, therefore, the relationship of the Cunard Line to the British government as a favored contract carrier re-

[66] Cornwall-Jones, pp. 190–191.
[67] Saugstad Report, p. 235.
[68] Meeker, pp. 23–24.

mained substantially undisturbed. Its position differed but little, in fact, from those of the Peninsular & Oriental and Royal Mail companies. This period of unchallenged operation was probably injurious to the enterprise of the line, and serious criticisms of its efficiency were made.

After the American Civil War the British government discovered that the economic conditions in the Atlantic liner trades were different from those prevailing on other routes. Not only was British enterprise firmly intrenched, but, in addition, it was evident that the demands of commerce were sufficient to maintain unaided several British organizations capable of providing high-class service. Hence it was unnecessary to maintain a quasi-public contract service by means of subsidies. The rivals of the Cunard Line were, indeed, highly indignant regarding the favors which it received. The result was that the payments made to the Cunard Line were reduced to £73,000 ($355,250) in 1868.[69] Much difficulty was experienced, however, in the letting of these contracts because of collusion.[70] Finally, in 1868 the Cunard Line received a seven-year contract for £70,000, which required a semi-weekly service. The Inman Line was also given a contract for a weekly service at half of this amount. Strange to say, a contract was also concluded with the rising German line, the North German Lloyd, in 1867 for a weekly service from Southampton to New York, the rate of pay being based on the weight of the mail carried. The total sum was much less than that received by the Cunard and Inman lines, however, being but £11,772 in 1868. This was clearly a departure from the British practice of developing British-flag contract services to various regions. So much difficulty was experienced in the award of contracts and criticism of the contractors was so widespread that in 1877, on the expiration of the contracts with these companies, a system of large poundage payments was adopted by the Postoffice.[71] This was, in effect, a shift to a limited general bounty policy, for in 1877 payments went to the Cunard, Inman, White Star, Guion, Anchor, and North German Lloyd lines.[72] These rates were probably not much above those being charged for ex-

[69] Saugstad Report, p. 236.
[70] Meeker, p. 15.
[71] Saugstad Report, p. 237.
[72] Saugstad Report, p. 237.

press cargo, since several lines refused to carry the mails at the rates first established. The total payment for the carriage of the mails to the United States fell from annual figures ranging between £109,000 and £118,000 under the mail contracts to £28,214 in 1877, and the Cunard Line's portion to £8,022 — a very great reduction. This arrangement remained substantially in effect in 1903, although on other routes the contract system was maintained. It was at this time that the rivals of the Cunard Line reached their greatest relative strength. This competition, which at first was nearly all British, was, indeed, beneficial both to the companies and the state, and there was scarcely any need for protection.[73] British shipping in the North Atlantic liner trades had fully matured and the state could afford to adopt a policy of laissez-faire.

This policy of liberalism was reversed as soon as British supremacy on this route was seriously challenged, and the policy of further developing special state-aided services of a superior quality, which had been formerly followed, was revived. The occasion was the strong bid of the German lines for power and the desire of the public that British vessels regain the supremacy. Again the Cunard Company received the preference. By a contract of 1903 a fixed payment of £68,000 ($330,900) per year was assured for a twenty-year period from the date that the last of two new high-speed ships, the *Mauretania* and *Lusitania*, sailed on her maiden voyage. These ships were expected to operate at from 24 to 25 knots. Furthermore, the Cunard Company, by the same contract, agreed to perform, or to stand ready to perform, special services to the state. Vessels were to be subject to hire by the government at an agreed rate, were to be fitted for carrying armaments, and were to be manned to a large extent by naval reservists. Provisions against chartering or selling any of the fleet were also included. Finally, the state loaned the company £2,600,000 at 2¾ per cent for twenty years and took one share of stock. Although this contract did not appear to be very important at the time, it marked the beginning of a new trend in shipping policy. Contractors thereafter tended to become more and more quasi-public agents conducting essential services, for which the government provided much of the capital.

[73] *Report of the* [British] *Select Committee on Steamship Subsidies* (1902), Parliamentary Papers, 1902, vol. IX, pp. x, xviii, xxv.

8

On other major routes the British government also assisted in the development of new major contract carriers flying the British flag. In 1889 the first contract was signed for the carriage of mails from Halifax or Quebec by rail over the newly built Canadian Pacific Railway to Vancouver, and thence monthly in vessels of 17½ knots to the Orient as far south as Hong Kong for £60,000 ($292,000), of which Canada contributed £15,000.[74] The Canadian Pacific Line thus secured a pioneer Pacific service which it still operates. The subsidy was subsequently renewed, a portion of the money being used to support a rapid transatlantic service by the same contractor. Lines were also supported running from the United Kingdom to the Cape of Good Hope, to Aden and Zanzibar, to Ascension and St. Helena, to the west coast of Africa, and on other minor routes.[75] Taken together, however, it is evident that the policy was to assure the development of strong British contract services on the important sea routes of the Empire, and to use contract subsidies for this purpose whenever necessary.

The effect of the British subsidies cannot be evaluated in detail, but it is evident that they exerted a powerful influence on the organization of the world shipping industry, its localization, and the development of British sea power. Many subsidies were definitely promotional in nature, and were persistently renewed until the desired results were achieved. Others were evidently designed to secure rapid communications between the outlying parts of the Empire and London, and to facilitate the movement of military forces. Some contracts required the shipowners to perform special services, such as the punctual provision of high-speed transportation regardless of seasons, costs, or business conditions. Often owners were required to hold their fleets available for government use, to refrain from undertaking certain actions normally indulged in by owners, such as chartering and selling, and to employ naval reserve officers and men. In 1885 Great Britain also established a policy of giving Admiralty subventions ranging as high as 20*s*. per gross ton annually to the owners of high-speed liners to constructed as to be convertible into auxiliary

[74] Saugstad Report, p. 230.
[75] A.R.C.N., 1901, p. 184.

armed cruisers or into troop transports.[76] By 1899 this fleet of special reserve merchant cruisers numbered thirteen vessels, to the owners of which the sum of £48,600 was paid.[77]

The total payments made for the maintenance of the packet service were never small, despite the great advantages possessed by British shipping. From a total equivalent to $4,076,447 in 1862, the amount fell slightly, then rose to $5,142,907 in the year 1868–69, after which there was another decline to $3,112,141 in 1887–88. From this point the sums expended slowly mounted, reaching $5,123,772 in 1898–99.[78] The total sum paid by the British and colonial governments during the years 1840–41 to 1899–1900 is estimated to have been the equivalent of about $230,000,000. This expenditure primarily built up the major regional contract services, and the effect on the general shipping industry was only indirect and secondary. In no sense does it appear to have been necessary for the maintenance of the British shipping industry at a high level of activity. Nevertheless, it resulted in the maintenance of superior vessels and of more regular and frequent services on the principal regional routes than would otherwise have been possible, enabled British lines to dominate many of the liner trades, and considerably augmented the total fleet. British ships prior to the World War were carrying 71 per cent by value of the carrying trade of the Empire, internal and foreign, and 52 per cent of the entire carrying trade of the world.[79] The size of the British steam fleet increased from 454,327 net tons in 1860 to 11,621,637 net tons in 1914.[80] Prior to the World War the net earnings of foreign exchange of this fleet were of the order of £100,000,000, which covered a large portion of the annual deficit in the commodity balance of trade, which deficit then was of the order of £140,000,000.[81] There can be little doubt that the contract subsidies gave prior position, economic strength, permanence, prestige, and quality to this industry, which it could not have otherwise achieved. The expenditure was, perhaps, a moderate price to pay for the economic security obtained.

[76] W. W. Bates, *American Marine*, pp. 89–92.
[77] A.R.C.N., 1901, p. 186.
[78] A.R.C.N., 1901, pp. 180–184.
[79] Fayle, *The War and the Shipping Industry* (1927), p. 6.
[80] A.R.C.N., 1916, p. 140.
[81] Fayle, *The War and the Shipping Industry*, p. 6.

9

The other major maritime nations were concerned during this period with the problem of building up their own transportation services and with overcoming the advantage of the British shipping industry, which, despite its comparatively high wage levels, possessed the lowest costs and the greatest elasticity of supply of any of the national industries. Nearly all devised defensive policies in accordance with their respective needs and abilities. The British government had been mainly concerned with exploiting the advantages of the British shipbuilding industry, of the economies of scale in ship operation, and of the prior occupation of trade routes in order to make the overseas communications secure in war and peace. Other governments, however, found it necessary to overcome a more or less serious differential in operating costs. For most of them, protection was vital for the survival of their mercantile marines as important carriers.

Foremost among these nations was France, the traditional enemy of Great Britain upon the sea. The economic position of French shipping during this period was quite unfavorable because of the high cost of ships built in France, the lack of capital and enterprise, and the failure to develop efficient management. Protection had been applied in the past mainly by means of discriminating duties and navigation monopolies.[82]

The state felt it necessary, itself, to establish through the Ministry of Finance, steamship services in the Mediterranean from Marseille to Italy, Greece, Turkey, and Egypt, on July 3, 1835, and later to Corsica and Algeria.[83] These ships were wooden steam frigates built in government arsenals and manned by naval officers and crews.[84] No cargo was carried, and the net expense to the government was estimated to have reached a total of 37,237,900 *fr.* ($7,177,000) by 1849. The French government therefore decided in 1849, as had that of England,[85] to turn these services over to a private contractor in an effort to increase economic efficiency.

The result was the formation of the first of the important

[82] *Report of the* [British] *Select Committee on Merchant Shipping* (1860), Parliamentary Papers, 1860, vol. XIII, p. vi.

[83] Saugstad Report, pp. 100–101.

[84] Charliat, p. 129.

[85] S.C.C.P.S., 1853, pp. 1–2.

French regional contract systems, which soon became the Messageries Maritimes, and the conclusion of a contract with this organization in 1851, calling for the payment of 3,000,000 *fr.* ($579,000) annually for ten years, and additional payments, diminishing at the rate of 100,000 *fr.* annually, for another ten years.[86] This company took over ten of the state ships, and built others. Three services — to Italy and Malta, to Turkey, and to Egypt — totaling 315,000 miles annually, were established from Marseille, which was the principal base of the Company, and a shipyard was acquired in which Company ships were built.[87] Further extensions were made in the 'fifties. In 1861, after the opening of ports in Cochin China, the Messageries Maritimes was selected by the government to establish French lines to India, China, and Japan from Suez.[88] Furthermore, the French state, which later became a heavy investor in contract shipping, made large loans for the construction of twelve ships. In 1881, the Company's services were again extended to New Caledonia and Australia, and in 1885 to East Africa. In the consolidated contract of 1911 the average rate of assistance on all routes was limited to $1.75 per sea mile, and speeds of 14 knots or better were required.[89] Although the form of the contract was altered from time to time, government support of this trunk service operating to the Levant and to the East was never abandoned, and, like the British contract companies, the Messageries Maritimes became a quasi-public organization with interdependent relations with the state.

The French government also found it necessary to establish other contract services covering the principal trunk ocean routes, especially those to North and South America. For this there was considerable precedent, for as early as 1783 a contract for a monthly service from Port Louis to New York for 30,000 *fr.* per voyage had been concluded with the firm of L. Colteux.[90] At about the same time twelve subsidized sailing packets were employed in a West Indian service, and four were engaged in a service to distant Mauritius and Bourbon.[91] In general, how-

[86] Saugstad Report, p. 102.

[87] Charliat, p. 137.

[88] Saugstad Report, pp. 103–104.

[89] Saugstad Report, p. 104.

[90] Saugstad Report, p. 98, citing Henry Grout, *Les Services Maritimes Postaux en France* (Thesis, Paris, 1908).

[91] Saugstad Report, p. 98.

ever, these services were costly and offered few advantages over those available by means of ordinary freighters, and hence in 1788 they were abandoned. Another effort to establish a contract service with sailing ships was made in 1827, when an agreement was reached with the firm of Gautier for a monthly service from Bordeaux to Vera Cruz and the West Indies for 5000 *fr.* per voyage, but this service was abandoned in 1832.[92] By an act of 1857, however, the government was authorized to establish direct steam contract services to North, Central, and South America. The first of these contracts was let by negotiation to the Compagnie Messageries Maritimes, then the principal government contractor, for a service, first starting from Marseille, but later from Bordeaux, to Rio de Janeiro and Buenos Aires, the subsidy under the revised agreement of 1861 being 2,306,172 *fr.* ($445,091) per year. This contract was renewed in 1886, 1894, and 1907, and was held by the Company until 1912, when a new contractor, the Compagnie de Navigation Sud-Atlantique, in which the Messageries Maritimes is believed to have had an interest, took over the service. The new contractor was required to operate a monthly 18-knot service on the route from Bordeaux to Lisbon, Dakar, Rio de Janeiro, and Buenos Aires, and an additional monthly freighter service touching at a larger number of ports.[93]

In the North Atlantic the principal contractor to the state was the Compagnie Générale Transatlantique, which was awarded its first contract on April 24, 1861, and has remained the principal French operator on this route to the present day. On the North Atlantic, foreign competition was considerably more severe than on the routes of the Messageries Maritimes, and considerable more assistance became necessary. Although the company had been founded in 1855 for general maritime operations involving fishing and trading,[94] it was necessary for the state to advance much of the money necessary for the building of its ships, the total advance being about $4,361,800, which was repayable over a twenty-year period. Furthermore, the subsidy was relatively high — 3,000,000 *fr.* ($579,000) for twenty-six voyages from Havre to New York each year, which sum was equivalent to about $3.59 per mile. In a contract of 1873 the number of voy-

[92] Saugstad Report, p. 99.
[93] Saugstad Report, p. 110.
[94] Charliat, p. 151.

ages was increased to forty, and the subsidy to 3,644,000 *fr.* The contractor also was paid 6,300,000 *fr.* annually under the agreement of 1861 for a service to Cuba, the French West Indies, Mexico, and Colon. In 1886 a new contract called for a weekly service to New York in vessels of at least 15 knots for the heavy sum of 5,490,000 *fr.* ($1,059,600) per year or $9.57 per mile, and, furthermore, additional speed bounties were given.[95] As a result the French greyhounds *Champagne*, *Bretagne*, *Bourgogne*, *Gascogne*, and *Touraine* appeared. Again in 1898 a new agreement was concluded, effective in 1901, calling for the building of four 22-knot ships and the acceleration of all services. The minimum subsidy was fixed at 5,000,000 *fr.* ($965,000) and speed bounties up to as much as 1,680,000 *fr.* ($324,200) could be added. This contract remained in effect until 1913. Thus, by means of persistent aid, loans, and other means France built up two large contract operators.

In addition, contracts were concluded for other services. Those to Tunis and Algeria were operated by the Messageries Maritimes from 1854 to 1871, by the Valery Line from 1871 to 1881, by the Compagnie Générale Transatlantique from 1881 to 1896, and thereafter by three companies, including the Générale Transatlantique until 1914.[96] In 1898 the Compagnie de Chargeurs Réunis and the Compagnie Marseillaise de Navigation received contracts for six voyages each to the West African coast. Contracts were also made for the Calais–Dover and Corsican services.

France thus established a group of important state contractors operating services on trunk routes, following the model of the English system. As in England the relationships between the contractors and the state became close and the same problems of administration arose. The subsidies were very necessary, however, in the case of France if French-flag services were to be developed and maintained, especially in competition with the great English contractors and efficient unsubsidized lines. No major French unsubsidized lines developed, except in the monopolized trades. The six leading French liner operators owned in 1914 246 steamships of 1,150,000 gross tons, or 66 per cent of the steel steam tonnage,[97] most of which vessels were employed in the contract service.

[95] Saugstad Report, pp. 117–118.

[96] Saugstad Report, p. 121.

[97] Chamberlain, *Liner Predominance*, p. 40.

In addition to the contract system, the French government found it necessary to establish a system of general navigation bounties designed to promote the expansion of tramp shipping. This was done as a result of the weakness of French shipping in general and the desire for increased national security. The bounties were first paid under the Act of 1881, but were insufficient to induce a substantial increase in French steam shipping. The total French fleet actually tended to decrease between 1881 and 1893, but the decrease would probably have been considerably greater but for the bounty and contract subsidies. The bounties were revised and increased in 1893, and again in 1902, but poor administration, defects in the law, lack of confidence, and inadequate payments prevented any large-scale expansion of steam fleet. The competitive disadvantage under which French shipping operated appears to have been too great to allow of much expansion by this means. The policy of France thus remained highly protectionist, on the whole, and the result was that at considerable cost a moderate-sized merchant fleet was maintained.

10

In Germany conditions were much more favorable, and government policies succeeded in developing a strong merchant marine. Prior to the formation of the German Empire the shipping activity of the Hanseatic cities had not been especially notable, although a moderate amount of wooden sailing tonnage had been maintained in service. From 1840 to about 1870 the rapid developments in the shipping world had only a small echo in Germany, which was content to watch the English lines grow, achieve economies of scale, and obtain strong economic positions. With the rise of industrialism, however, German oceanic commerce grew, capital supplies became more plentiful, and German economic leadership more efficient and daring. Furthermore, the free purchase of the best products of English shipyards was possible. On the whole, therefore, the margin of advantage of the British shipping firms was not great, and in the case of the shipping lines could be easily overcome by efficient management, the development of economies of scale, and some government assistance. It was, therefore, inevitable that the state should undertake measures for the development of German shipping, especially

since Kaiser Wilhelm II came under the influence of Mahan and desired to establish Germany as a sea power.

It is notable that German shipping lines exhibited a marked ability to establish themselves without state aid, thus proving that their disadvantage was not serious and that their management was enterprising and efficient. The important Hamburg–Amerika Line was founded on May 27, 1847, to conduct a packet service between Hamburg and New York.[98] At this time the American sailing packets dominated this business, and the line's four sailing packets of about 700 gross tons failed to make a notable impression. In 1856, however, it completed its first two steamers, the *Borussia* and *Harmonia*, and thereafter expansion was rapid. By the time of the Franco–Prussian War it owned forty-seven steamers which made 276 round voyages each year. Likewise the North German Lloyd of Bremen made rapid progress after its founding in 1857.[99] The liner *Bremen* made its first departure in June of the following year. During the Civil War this company was especially prosperous and returned good dividends. Both lines were excellently managed on the whole, the leaders being Cruesmann of the Lloyd and Bolten and Albert Ballin of the Hamburg line. Both lines were able to enter new fields, the Hamburg line, for instance, establishing services to New Orleans, Havana, and Mexico in 1867. Another line, the Hamburg–Sudamerikanische Dampschiffahrt Gesellschaft was founded in 1871, and soon prospered under the direction of Heinrich Amsick.[100] The Neptun Dampschiffahrts Gesellschaft, founded in 1873, also soon developed an important place in the coastwise trade of Europe.[101] In 1878 the old house of Carl Woermann began the operation of its steamers between Hamburg and West Africa.[102] In general, it is evident that German shipping enterprise developed with considerable vigor without state aid.

It was unnecessary, therefore, for the government to undertake elaborate measures such as were developd in France. Indeed, it was the view of Albert Ballin, the Director-General of the Hamburg–Amerika Line, that contract subsidies hindered rather than assisted the development of shipping enterprises because of the inflexibility of the services so established, the frequent lack of

[98] Dussol, pt. I, p. 13.

[99] Dussol, pt. I, p. 38.

[100] Dussol, pt. I, p. 99.

[101] Dussol, pt. I, p. 59.

[102] Dussol, pt. I, p. 63.

adaptation of the services to the needs of commerce, and extravagant expenditures.[103] This was, in fact, a valid criticism of some of the British, French, Italian, and American services, which suffered both from lack of commercial support and inefficiency, but failed to recognize fully the special reasons for the creation of many such lines. The German government indeed took no action until 1881, when Bismarck submitted a report on foreign subsidies expressing some doubt regarding the ability of German shipping to compete under such conditions.[104] This resulted in a subsidy law of 1881, as a result of which the government undertook to subsidize certain services deemed necessary for imperial welfare. Under this law an agreement was concluded with the North German Lloyd, effective in 1886, for Far Eastern services to Shanghai, Japan, Australia, the Tonga Islands, and Samoa, and for a Mediterranean Service from Trieste to Alexandria, for a total sum of RM 4,400,000 ($1,047,200). In 1898 another contract calling for an accelerated service for a payment of RM 5,590,000 ($1,330,420) per year, was concluded.[105] Subsidies were continued to ships operating on this route until the World War. Another contract enabled the German East African Line to establish in 1890 its service to Delagoa Bay, Zanzibar, and the Cape of Good Hope by way of Suez, the first subsidy being RM 900,000 per year. Furthermore, all German shipping was helped by preferential railroad rates for through shipments over German steamship lines.[106] German shipping policy soon became closely allied to German imperial and naval policies, and the state did not hesitate to adopt protectionist policies when necessary.

The rise of the German shipping lines was, in fact, an extraordinary phenomenon, and must be attributed to the German genius for efficient organization and the preferential rail rates. The Hamburg–Amerika Line's fleet rose from 13 steamships and 9 sailing ships in 1857 to 58 steamships in 1895, and to 158 steamships in 1906. Its services reached Canada, the United States, the West Indies, Mexico, South America, the Pacific Coast, Asia, and the Mediterranean.[107] The *Auguste Victoria* made what were

[103] Dussol, pt. I, p. 11.

[104] *Report of the U. S. Consul General on German Steamship Subsidies* (1881), House Misc. Doc. no. 234, 51 Cong., 1 Sess., p. 118.

[105] Saugstad Report, p. 182.

[106] Saugstad Report, pp. 190–191.

[107] Dussol, pt. I, pp. 31–37.

probably the first pleasure cruises in 1897 and 1898, the first being to Norway, and the second around the world. By 1906 the North German Lloyd also possessed a large fleet consisting of 194 steamships. Control of German shipping was highly centralized, for thirteen corporations controlled in 1914 696 steamships totaling 3,963,000 gross tons, or 79 per cent of the total German steel tonnage of vessels of 100 gross tons or more.[108] German tramp shipping, in which economics of large scale were less significant, fared comparatively poorly. The rapid rise of German shipping illustrates the instability in localization which may develop when economies of scale are available to the owners of countries in which economic conditions are similar.

II

We have now seen that the economic development of the shipping industry in the three principal powers of Europe was greatly affected by various measures affecting competition and stimulating expansion. The same was true in a number of smaller nations. The system of protection in Italy closely resembled that of France, it having been held that it was desirable from both the commercial and military standpoints for the state to promote ocean transportation services. Like that of France, the system consisted of a number of contracts for special services, and of general navigation bounties. The state-owned services which had been operated during the first part of the century were turned over to private contractors under a law of 1851 in order to secure economy.[109] Most of the mail contract services were confined to the Mediterranean, although a short-lived subsidized line to New York was established. Under the laws of 1912 and 1913 the total sum paid on contract subsidies was about $3,715,000 annually.[110] In addition, beginning in 1885, navigation bounties were paid which between 1886 and 1914 totaled $15,575,000, of which $11,229,000 was for steam navigation.[111] Although the free-ship policy was generally followed, elaborate shipbuilding bounties were also given. These aids provided Italy with a moderate-sized merchant marine and a control over most of her sea communications in the Mediterranean. It was not until after the World War, however, that Italian shipping was so organized and developed

[108] Chamberlain, *Liner Predominance*, p. 38.
[109] Saugstad Report, p. 269.
[110] Saugstad Report, p. 271.
[111] Saugstad Report, p. 275.

as to secure for itself great prestige and economies in operation.[112]

The Netherlands government, in order to increase the comparative efficiency of the Dutch transportation system, also developed a system of contract services resembling those of Great Britain. A group of important contractors was developed, the relations of which with the state were relatively stable. Dutch shipping had been in a relatively favorable economic position for some time, but the contracts insured regularity, high speed, a heavier capital investment, and greater maritime security than might have been expected under laissez-faire. For services to the Dutch East Indies, contracts were made in 1870 with the Nederland Steamship Company, and later with a coöperating firm, the Rotterdam Lloyd.[113] These lines remained the principal contractors until after the World War. The two companies together formed a third, the Royal Packet Navigation Company, which, beginning in 1888, operated contract services centering in the Dutch East Indies.[114] The same interests also established the Java–China–Japan Line in 1902, which received a mail contract and a government loan for the building of vessels. This service connected Surabaya, Samarang, Batavia, Hong Kong, Amoy, Shanghai, Kobe, and Yokohama. Another East Indian contract service, the Java–Australia Line, was established in 1911. In the Western Ocean the Royal West Indian Packet Line began contract operations from Amsterdam to Curaçao and Surinam in 1882, and somewhat later from New York to these ports, for a small subsidy. Another contract line was established between Amsterdam and South America in 1900. Dutch subsidies were comparatively small, however, and exerted a minor influence on the development of Dutch shipping, although in some cases they definitely tipped the balance in favor of expansion.

A number of other nations maintained or established subsidized contract services during this period. Among these was Spain, which despite her decline still recognized the importance of sea power. State steamship services to the West Indies, begun in 1850, were turned over in 1868 to a contractor which eventually became the Compañia Transatlantica Española, the principal

[112] Chamberlain, "The Italian Ship Subsidy System" (U. S. Department of Commerce, 1928).

[113] Saugstad Report, p. 361.

[114] Saugstad Report, p. 363.

state contractor.[115] In a contract of 1886 this company was required to make thirty-six voyages annually to the West Indies, thirteen voyages to Manila and eastern ports, six voyages to South America, four voyages to the Atlantic Islands and the west coast of Africa, and twenty-four voyages to North Africa. The subsidies totaled $1,689,044 annually. In 1909 the contracts were renewed and extended, and the Company was required to maintain thirty vessels in service. General bounties on the French model were also paid to tramp owners under the 1909 law.

Japan also began to give mail subventions as early as 1890, and these were greatly extended in 1896. The Nippon Yusen Kaisha, which is today Japan's premier shipping organization, then received subsidies equivalent to $2,141,330 annually for four services to London, Seattle, Australia, and India and the East Indies.[116] The Toyo Kisen Kaisha also received a contract for a San Francisco service, and there were others to China, the total sum paid being $2,812,609 annually. In addition generous general navigation bounties, which reached $2,911,784 annually, were given under a law of 1896. The payments for both types of aid were approximately $3,781,000 in the year 1914–15. In addition there were important shipbuilding bounties. This aid had the effect of expanding Japan's infant maritime industries at high speed, and by 1914 Japanese shipping was dominant in the Pacific trades. Belgium also supported certain contractors to a moderate extent.[117] Brazil organized in 1890 a quasi-state company, the Lloyd Brasileiro, which operated lines coastwise and to New York under subsidy.[118] Sweden, whose shipping industry was basically in a favorable position, maintained a number of contract services, but the grants were exceedingly small. Austria, however, established a network radiating from Trieste, the principal contractor being the Austrian Lloyd, a quasi-governmental organization. In 1891 this concern was operating under contract nineteen mail lines which reached as far as India, China, and Brazil.[119] Only Norway, Denmark, Greece, and the South American republics, excepting Brazil, followed a policy of comparative laissez-faire. The total number of vessels maintained in service

[115] Saugstad Report, p. 534.
[116] Saugstad Report, p. 323.
[117] Saugstad Report, pp. 434–435.
[118] Saugstad Report, pp. 441–442.
[119] Saugstad Report, pp. 418–419.

by all of these contractors and protected enterprises was very large.

It may be concluded, therefore, that every important power of Europe, and also Japan, Brazil, and some of the British dominions, employed the subsidy to expand, protect, and control its shipping. As we shall see, the United States also added a small number of contract liners. The subsidy thus rapidly displaced the obsolete and anachronistic navigation monopolies and discriminating duties of earlier times. These subsidies were generally paid by the foreign taxpayers. The extent to which they represented a waste from the standpoint of foreign governments and citizens is, however, a moot question, and can probably never be fully determined. To a certain extent it is clear that the contract services provided facilities to business for which it was willing to pay taxes, just as it was for the internal mail service. The imperial governments also presumably secured benefits in administration. For Great Britain the British steamship network was the equivalent of a national railroad system. It bound together the scattered parts of the Empire and linked Britain, chiefly by radial lines, with all parts of the world. Perhaps there was as much justification for the creation of these services as there was for the building of the western railroads of the United States by the aid of subsidies. In any case, the military value of these services was very considerable. Therefore, regardless of the merits of the subsidies and of the burdens and benefits so created, it is important to recognize that strong governments everywhere realized the public importance of the shipping industry and took measures for its development and regulation during this period.

CHAPTER XVI

AMERICAN CONTRACT LINES AND INTERNATIONAL POOLS, COMBINES, AND STEAMSHIP FLEETS

I

It is thus evident that during the last half of the nineteenth century a network of contract line services was developed by all of the principal foreign powers. In addition, France, Italy, Spain, and Japan provided bounties to promote the operation of tramp ships. The contract lines, in general, radiated from each of these countries along the principal trunk routes of ocean commerce. The majority of these rival national services did not compete fully with others along their entire routes, but many had common ports of call, especially in the Oriental and South American trades. Japan and the United States were the only important non-European powers which succeeded in establishing services radiating back toward Europe in direct competition with those of the respective European governments. All of the contract services possessed a degree of rigidity not commonly found in free shipping enterprise. In most cases, the contractors were required to maintain a minimum number of sailings in vessels of a given size, speed, and build, and normally the routes and ports of call were also specified. The subsidies were usually sufficient to cover the extra expense of maintaining such services and to cover normal operating-cost differentials as well. Many also covered the special costs of establishing national services on routes already occupied by foreign contractors. Thus conditions highly favorable for the development of pools and combines were created.

The history of the European contract lines suggests the conclusion that the basic cost conditions were quite similar in many of the major European states within the limits of expansion imposed by the volume of resources of each country, and that success in ship operation was largely a function of management, economies of scale, good will, prior occupancy of trade routes, and persistence. Certainly great shipping lines were matured with considerable success in all of the maritime countries by means of

subsidies or other effective means, such as preferential rail rates, and each nation secured a more or less dominant position on its own principal trade routes. In the case of the line services, indeed, the economies and selling advantages of the great concerns appear to have been so large as to overshadow all other cost factors, so far as the countries of Europe were concerned. In tramp shipping, however, these economies were less important, and the ownership of such tonnage, therefore, tended to center where costs, especially interest rates, were lowest. It is notable that the European powers, even those possessing great natural advantages, persisted in supporting one or more large-scale contractors, and were able to do so with little difficulty. Effective organization, therefore, counted for much in the liner trades.

This, then, was the situation faced by the United States government in developing its navigation policy in the steamship sector after the Civil War. The previous subsidy policy had been abandoned and conditions in the steam shipping business had become chaotic. American steamship firms collapsed rapidly as a result of the depression of 1857, the flooding of the carrying trades with fast sailing ships and modern new steam vessels, the improvements in the designs of foreign ships, and the abrogation of the mail contracts in 1857. The Collins Line failed dismally, and its obsolete ships were sold to pay the claims of creditors. The last sailing was made by the *Baltic* on February 3, 1858.[1] The fact that the line had never paid a dividend on its capital was not a good recommendation to future investors. The Bremen Line was also abandoned and liquidated in 1858 by its German backers in favor of the North German Lloyd, and the Havre Line also, crippled by lack of earning power and new capital, soon disappeared after war began.[2] Commodore Vanderbilt attempted in 1857 to operate a Bremen service, for the sum of the regular sea postage, with several large wooden paddle ships which had been released from the Panama service by the decline in traffic. Among them was the huge *Vanderbilt*, 3361 gross tons, which had been built in the years 1856–1857 at Greenpoint and had cost over $1,000,000.[3] Other wooden paddle vessels, including the *North Star*, *Northern Light*, *Ariel*, and *Ocean Queen*, were added, but the venture was unsuccessful and was abandoned in 1861.[4]

[1] Albion, *The Rise of New York Port*, p. 330.
[2] Marvin, p. 278.
[3] Marvin, p. 278.
[4] Dayton, p. 364.

Another attempt to establish a line was made in 1863 when the American Line, which was to operate a Boston–Liverpool service, was chartered in Massachusetts.[5] Despite much promotion work by the Board of Trade, only $800,000 could be raised for its capital, however, and the Company found it impossible to secure American-built steamships at suitable prices. An investment in a foreign-flag line was at first considered, but finally the wooden paddle steamships *Erie* and *Ontario*, of about 3000 gross tons, were built at Newburyport at a cost of $750,000 each. The *Erie* made but three voyages in the line's service, and the *Ontario* never went to sea in it at all. Another firm, Ruger Brothers, established in 1866 a service averaging ten trips a year from New York to Baltic ports and Germany with second-hand wooden paddle ships, but after four years this likewise collapsed. This was due in part at any rate to the use of "fighting" ships and other unfair methods of competition by rivals.[6] It thus became evident that in line operation American costs were too high and the scales of operation were too small to permit American shipowners to compete, although the owners of sailing ships were still able to achieve some success in the long-voyage trades.

The position of the owners of steam vessels was, indeed, extremely unfavorable throughout this period, despite the rise of American industry and commerce. Foremost among their problems, as has been indicated, was the necessity of using high-cost American-built tonnage, the price of which varied between 25 and 50 per cent above that of foreign tonnage. In addition there was a substantial differential in operating costs. Wage rates varied greatly according to the route, the size of the ship, and port of signing, and hence a comparison is difficult. Nevertheless there is ample evidence that wage expenditure alone was well above that of foreign owners. For instance, a careful estimate in 1869 showed that wages on British liners were but 69 per cent of those on American vessels.[7] Able seamen on American steamships leaving New York for South America received $40 per month in 1872, but by 1879 the rate was down to $25 per month.[8] In contrast, British steamships leaving London and Liverpool for

[5] Statement of H. A. Hill, Secretary of the Company, *R.B.B.T.*, 1865, pp. 33–36; Nimmo Report, p. 11.

[6] Nimmo Report, p. 11; Tyler, p. 335.

[7] Nimmo Report, p. 58.

[8] Farquhar Report, p. 279.

South America paid about $15 per month in 1870 and 1880.[9] American steamships appear, however, to have sailed much more lightly manned than British ships. For instance, in 1881, on eight American passenger liners the manning scale was one man to 40½ tons, whereas on eight British steamships it was one man to 20½ tons.[10] On freighters, however, the situation was reversed. British vessels carrying one man to 51 tons, and American vessels one man to 40¼ tons.[11] Thus in engineering and navigation British ships were more efficiently manned, but in the passenger trades they could afford to employ more labor and to provide more services to the passengers. An interesting comparison in 1901 of wage expenditure on the express transatlantic liners *St. Louis* (American) 11,629 gross tons, *Oceanic* (British) 17,274 gross tons, and *Kaiser Wilhelm der Grosse* (German) 14,349 gross tons, shows a monthly payroll of $11,306 for 380 men on the American ship, $9,891 for 427 men on the British ship, and $7,716 for 500 men on the German ship.[12] At the same time a comparison of monthly wages on small freighters showed $860 for nineteen men on an American ship, $491 for eighteen men on a British ship, and $341 for fourteen men on a less-heavily manned Norwegian ship.[13] In addition, the expenditure for food was somewhat greater on American ships. Thus American vessels operating in the Atlantic were at a considerable disadvantage. Ships sailing on the Pacific, especially to China and Japan, encountered much greater differentials when competing with Japanese shipping, although by using Oriental seamen, engine-room men, and stewards, as was done on the Pacific Mail ships, the costs of operation could be reduced.[14]

It may be concluded, therefore, that American shipowners encountered severe competition from those operating foreign ships, the running expenses of which were usually from 25 to 50 per cent less — a differential too great to be overcome by large-scale operations or by merely increasing efficiency. It is likely, however, that the creation of large firms on the British, French, and German models and the adoption of a free-ship policy would have greatly reduced the disadvantage under which American

[9] A.R.C.N., 1901, p. 98.

[10] Dingley Report, p. 55.

[11] Dingley Report, p. 55.

[12] A.R.C.N., 1901, p. 107.

[13] A.R.C.N., 1901, p. 107. The ships were the *Northeastern*, *Taff*, and *Vigsnaes*, respectively.

[14] R.M.M.C., II, 939.

shipping operated, especially in the case of the vessels running in the relatively non-competitive trades to non-maritime nations.

2

The government of the United States faced a major problem in economic policy as a result of this situation. There was no doubt that, although the superb full-rigged ships from Maine and Massachusetts could still be sailed in some of the world carrying trades, the unaided operation of American-flag steamships in the foreign carrying trades was economically impossible except in nearby West Indian waters, where close commercial ties provided a small amount of protection. Thus, paradoxically, the American merchant marine was passing through the period of intense economic and industrial development of the latter part of the nineteenth century with strong reliance on the use of big wooden sailing ships. Such vessels were, however, of small value in time of war. A reorientation of American policy was therefore long past due. The government failed, however, to recognize the importance of the changes in organization and in foreign policies which occurred, and its policy was, therefore, weak and uncertain.

There were two important problems to be considered. First, it was necessary to determine whether or not in the interest of the economic and military security of the country in time of war it was desirable to pursue a policy of comparative laissez-faire in respect to the shipping industry and to submit to the overwhelming control of the American overseas carrying trades by numerous foreign contract carriers, bounty-fed tramps, and efficient unaided enterprises. As has been shown, practically all of the other principal powers, except Russia, developed their navigation policies with close reference to potential military needs. Strong measures were taken in Great Britain, France, Germany, Austria-Hungary, Italy, Spain, and Japan to provide at least minimum amounts of high-grade tonnage under the national flag in order to prevent these nations from becoming highly vulnerable to a withdrawal of foreign shipping in time of war and to provide a minimum force of skilled personnel. In the case of the powers which were likely to secure control of the sea or of a part of it in time of war, such as Great Britain, France, and Japan, this policy was complementary to their naval policies. Indeed, in a

period of rising nationalism the failure to take some precautions exposed to great risks a power which might be forced to go to war and which required secure and efficient ocean transportation services. Even neutrals in a position such as that of the United States might suffer seriously from a shortage of tonnage. This viewpoint was emphasized in naval circles in the United States, notably by Admiral Mahan, and by imperialists and protectionists in many lands abroad. It was also presented, perhaps too vigorously, by the shipowners and shipbuilders, who naturally accepted the argument without restriction.

Although these arguments made some impression in the United States, the government, nevertheless, failed to take adequate measures to develop the merchant marine to meet the needs of the country in a major military effort, with the result that on the outbreak of the World War American foreign commerce was seriously crippled by the lack of shipping facilities. When the United States itself went to war the situation became much worse, and the government was forced to embark on a program of ship construction under conditions of high costs. Under this policy there eventually were completed 2312 ocean-going craft, of which 1309 vessels totaling 8,927,695 gross tons were of steel.[15] Looking backward, it appears, therefore, that the failure to solve the shipping problem and to take adequate and effective measures was a mistake. In the modern nationalistic world it is necessary to give due consideration to the problems of economic and military security even while attempting to maximize the national income. It may be concluded that American shipping policy after the Civil War was inadequate to provide reasonable economic and military security, was even unnecessarily restrictive of enterprise, and lagged far behind that of important foreign powers in vigor.

3

Second, it was necessary to determine the effect of the rise of huge foreign contract carriers and monopolistic combines on American shipping and trade. There is little doubt, in fact, that on many trade routes free competition of the type formerly existent almost entirely disappeared, and in its place a condition of polyopoly arose, which led to amalgamation, large-scale enterprise, and self-regulation by the industry. Cutthroat competition

[15] United States Shipping Board, *Sixth Annual Report*, 1922, p. 259.

became an ever-present danger, especially in business recessions, because of the large overhead costs prevalent in the industry and the rigidity of the sailing schedules, many of which were maintained under rigid subsidy contracts. Indeed, there was nothing to prevent freight rates from falling almost to zero if competition between rival subsidized contract carriers became severe, there was excess capacity, and the elasticity of demand for space was low. The risks of the business therefore became high, and as a result owners strove to secure their positions by the establishment of conferences, by the creation of combines, by the building up of clienteles by means of advertising, solicitation, and differentiation of service, and by obtaining secure sources of traffic through agreements with railroads and shippers. The established lines soon began to combine against newcomers, both liners and tramps, and to divide the business among themselves according to a formula. In the face of such a situation, new unsupported firms, whatever their basic advantages, had little hope of readily securing suitable places in well-organized carrying trades. Only large size and economies of scale, efficiency, and strong state support could enable newcomers to obtain satisfactory permanent places in many of the principal liner trades.[16] The decline of competition and the growing importance of monopolistic and unfair tactics thus raised serious problems, for the free equilibrium which had formerly been found gave way to an unstable administered equilibrium.

There is ample evidence that by 1914 American overseas traffic was extensively subjected to the regulations of monopolistic organizations, which were primarily controlled abroad, and that such organizations were able to adopt methods which tended to restrict the operations of American shipping firms, which were weak and in a marginal position. All of the evils of unregulated railway competition arose in the shipping industry, including rebating, discrimination, and predatory competition. A tendency to fix rates in accordance with the principle of ability to pay became evident, thus indicating some degree of monopoly, but at competitive points and in cases in which shippers could exert pressure severe rate-cutting appeared. Agreements to rationalize service also became common. Actual and potential American

[16] *Report of the* [British] *Select Committee on Steamship Subsidies* (1902), p. xxv.

steamship firms were inevitably affected by these business practices. The conferences soon showed themselves especially adept in the use of these tactics. Hence the fact that between 1875 and 1895 conferences were established in all of the major carrying trades radiating from Great Britain except the North Atlantic trade,[17] and soon afterward were established in the Atlantic trade also, was significant. By 1914 over eighty agreements among firms operating in the American foreign carrying trades had been formed.[18]

These conferences and agreements were designed to regulate the competition of the members and to defend the members against outsiders. Some agreements provided for definite rate-fixing.[19] Others provided for minimum rates on various products, and contained provisions to prevent any members from receiving more than their share of the business. In many cases fixed differentials in rates were provided for various classes of vessels. Rate leadership sometimes appeared in trades in which one large organization dominated the traffic and was in a position to punish severely any small firm tending to cut rates or to threaten its position. Sometimes lines agreed not to touch at certain ports within each other's spheres of influence. Frequently agreements to limit and space sailings of the members were concluded. In some cases fixed maximum proportions of the traffic for certain firms were set. In the highest types of conferences the receipts were pooled according to an established formula. Frequently a system of deferred rebates, amounting to 5 or 10 per cent, was used by conference lines to prevent shippers from patronizing outsiders.[20] When this method proved to be ineffective, the conferences often arranged to employ "fighting" ships against outsiders, which vessels were scheduled to sail at the same time as those of the outsider and were prepared to cut rates to zero, if necessary. Another restrictive measure of the same type was the exclusive contract with large shippers and railroads. The effect of these

[17] R. H. Thornton, *British Shipping* (1939), p. 278.

[18] *Report on Steamship Agreements and Affiliations* (1914), House Doc. no. 805, 63 Cong., 2 Sess., p. 281. (Hereafter cited as the Huebner Report); *Report of the* [British] *Royal Commission on Shipping Rings and Deferred Rebates* (1909), Parliamentary Papers, 1909, vols. XLVII–XLVIII.

[19] For a description of these practices see Huebner Report, chap. X.

[20] *Report of the* [British] *Royal Commission on Shipping Rings* (1909), Parliamentary Papers, 1909, XLVII, 27–61.

agreements and unfair measures, together with that of the subsidies, was to make the liner trades rigid and difficult to enter.

These agreements seriously affected many American sea routes by 1914. In the North Atlantic trades in 1892 a community of interest was formed, involving the Hamburg–American Line, the North German Lloyd, the Holland–American Line, and the Red Star Line, which was designed to control competition in the passenger traffic, in which it had become cutthroat.[21] By 1912 some twenty-eight lines, comprising all of the important firms in this trade, were affiliated by agreement and were members of one or more of the four conferences which regulated various regional sectors in the transatlantic trades.[22] These agreements completely controlled the liner traffic in passengers from Western Europe, the Baltic, and Mediterranean to the United States and Canada, and involved the allocation of percentages of the business. Furthermore, a group of agreements involving the carriage of freight on these routes seem to have been in effect also among some forty lines.[23] Agreements were also then in effect among the lines operating from the United States to Africa, Australia, South America, the Orient, the West Indies, and Central America.[24] By 1914, these agreements had become all-pervasive, competition everywhere tended to decline, and the equilibrium of each firm, instead of being freely determined under competitive conditions, came to depend largely on institutional factors, such as bargaining power at the conference table.

It is not contended that the development of these conferences was necessarily undesirable. On the one hand, under the conditions which came to prevail the control of competition by some agency became essential if chaos was to be avoided. This had already been proved in the case of the railroads, and had resulted in the Interstate Commerce Act of 1887.[25] Indeed, the establishment of conferences was the first stage in the organization, coördination, and rationalization of a hitherto disorganized competitive industry. These all-pervasive agreements provided many advantages. They provided for stability in rates, for or-

[21] Erich Murken, *Die grossen Transatlantischen Linienienreederei–Verbaende, Pools, und Interessengemeinschaften bis zum Ausbruch des Weltkrieges* (1922), p. 26.

[22] Huebner Report, p. 22.

[23] Huebner Report, p. 59.

[24] Huebner Report, pp. 91–279.

[25] Eliot Jones, *Principles of Railway Transportation* (1931), pp. 61–63, 91–103.

dered regularity of sailings, for greater security to capital, for less duplication of facilities, for less competition in advertising and solicitation, and for greater convenience to shippers.[26] Generally secret rebates and discriminations were restricted — a valuable contribution. The resulting rationalization, elimination of waste, and greater stability must have tended to reduce the costs of service. Furthermore, a more rational geographical layout of regional steamship networks was secured than would have been possible under full competition.[27] On the other hand, the conferences possessed great arbitrary power over rates, although this power was somewhat checked by the competition of tramps, the looseness of many agreements themselves, and fear of state regulation. Conferences also tended to penalize small shippers which were unable to charter tramps, to arrange tariff schedules arbitrarily, to make secret agreements, to change rates suddenly, and, in general, to treat complainants and shippers generally in a cavalier manner.[28] Furthermore, rate levels may have been higher than was warranted by the costs of service. The maintenance of profit ratios probably also caused member firms to expand unduly, with the result that excess capacity developed and costs of operation rose. Political maneuvers likewise tended to increase overcapacity. All of these problems were typical of the industries in which imperfect competition and self-regulation came to prevail.

The implications of the growth of monopoly and organization for national navigation policy were important. The normal effect of the conferences and communities of interest was to freeze the status quo. Only powerful, well-financed lines could force their way into controlled liner trades, and few American firms stood in this category prior to the World War. Furthermore, many of the conference arrangements were necessarily based on foreign subsidy policies, for at the core of many of the conferences stood one or more great contract carriers, British, French, German, Italian, Spanish, Dutch, or Japanese, which were under contract to provide a given service. These conferences were, in part, designed to prevent the rates of such lines from falling unduly. Almost all conferences, therefore, provided for some system of pooling or division of the traffic, thus preserving the status quo

[26] Huebner Report, pp. 295–299.

[27] Huebner Report, p. 303.

[28] Huebner Report, pp. 305–307.

and making difficult the rise of a new firm. The contract carriers were particularly desirous of eliminating excess capacity. The conference lines, backed by their collective resources and contract subsidies, were thus in a position to drive out unsubsidized ships with comparative ease. They could even indirectly injure lines operating on other routes by quoting lower rates for the long roundabout haul than for the direct haul. This was done, for example, by European lines, which carried American goods to South America, Australia, and Africa by way of Europe. The original occupiers of the steamship routes thus had many advantages under this system, and these, it will be recalled, were mainly European firms. Indeed, in many cases, contracts with shippers and railroads forced traffic into predetermined grooves. Under such conditions, competitive advantage in costs was only a minor factor determining the outcome. Only strong, state-supported carriers or government-owned shipping could hope to achieve a firm position in many such liner trades. It seems, therefore, that the policy of comparative laissez-faire followed by the United States played into the hands of such established organizations and tended to freeze the existing situation. Conferences were, indeed, very advantageous to the established foreign lines, especially the great contractors. The fact that this was the case was belatedly recognized in the American Shipping Act of 1916 and later laws, which subjected conferences to considerable control.

4

Following the Civil War, American policy with regard to subsidies, in contrast to that of foreign governments, was vacillating and ineffective. The cost of a strongly protective policy under the ship-registry policy in effect would have been high, and it would have been considerable under any conditions. Large sections of the country were therefore unwilling to support such a policy. The free-trade interests were unable during much of the period to remove the absolute protection accorded the shipbuilders and the burdensome duties on shipbuilding material, and the protectionists were unable to obtain a subsidy bill. Hesitatingly and intermittently the government provided costly contract subsidies for a few lines. On the great majority of the steamship routes, therefore, the traffic fell into the hands of subsidized and unsubsidized foreign vessels. Only in the carefully guarded coastwise

trade did American steam shipping develop with vigor. American policy was, in fact, insufficiently strong to develop powerful shipping organizations, although it sufficed to produce a number of poorly financed and badly managed enterprises which were costly and inefficient.

Two important contract subsidies were granted during and immediately after the Civil War, namely those to the lines operating to Brazil and to the Orient. Both enterprises were somewhat more successful than the lines of the 'fifties, although the same weaknesses resulting from the lack of regulation of accounts, finances, and expenditures appeared. Both lines did not at first directly compete with any important foreign contractors, and thus the principle of directly rivaling foreign contract services was abandoned. Both services were established instead to promote traffic, and to offset the commercial advantages secured by importers and producers in England and France because of the extensive operations of the Royal Mail and Pacific companies and of the Messageries Maritimes on the routes to South America, and of the Peninsular & Oriental Company and the Messageries Maritimes in the Far East. There was, indeed, more justification for the establishment of services on these routes than on many others, for they tended to complete the world-wide network and to move the United States relatively closer to the economic life of these regions.

The Brazilian service was authorized by the Act of Congress of 1864,[29] which provided for a line of 2000-ton steamers sailing monthly to St. Thomas, which was the Royal Mail Packet Station, Bahia, Pernambuco, and Rio de Janeiro.[30] The government of Brazil was also interested, and contributed $100,000 annually. A contract for this service was negotiated with the United States and Brazil Steamship Company in 1865, the compensation paid by the United States being $150,000 annually, and the total received by the Company $250,000. The Company was operating three ships in 1870, namely the iron screw steamer *Merrimack*, 2031 gross tons, the wooden paddle steamer *North America*, 2050 tons, and the wooden screw steamer *South America*, 2050 tons.[31] The Company's ships were soon obsolete, however, and it failed to secure a renewal of the American portion

[29] 13 U.S. Stat. 93 (May 28, 1864).
[30] Saugstad Report, pp. 57–58.
[31] Lynch Report, p. 272.

of its subsidy in 1875,[32] with the result that the ships were sold to the Pacific Mail Company.[33] It did, however, secure some aid from the Brazilian government again in 1879, and after a reorganization it was able to obtain three new steel ships from Roach's yard in 1883.[34] The line was finally withdrawn, however, in 1893,[35] although it had been awarded a contract under the Act of 1891.[36] In 1890, it was reported to be unprofitable, despite a subsidy of $95,000 from the Brazilian government.[37] Thus another weak poorly supported and poorly regulated American line passed from the seas.

The Oriental service was established in order to improve American transport relations with Japan and China and to supplement the services provided by the Panama steamships and the Union Pacific Railroad.[38] The United States was at this time rapidly extending its influence westward, and the development of a great trade with the Orient through the port of San Francisco was envisaged. Again it was a case of building ahead of the traffic. The act authorizing this service was passed in 1865,[39] and resulted in the award of a ten-year contract for a monthly service in 3000-ton ships to the Orient via Hawaii to the principal steamship operator on the Pacific, the Pacific Mail Steamship Company, at the maximum figure of $500,000 annually.[40] Such a service was bound to be costly because of the great distances involved, namely 1990 miles from San Francisco to Hawaii, and 3478 miles from there to Yokohama, and of the expense of maintaining fuel depots; but the government felt that the benefits would eventually justify the expenditure. In order to reduce expense and speed up the service the Company's ships were soon placed on the direct 4800-mile route from San Francisco to Yokohama, thus saving three days westbound and four days eastbound. By 1870 the Company had in service four wooden paddle steamships, the *Great Republic*, *China*, *Japan*, and *America*, all of which were between 3800 and 4400 gross tons in size.[41] It was

[32] Seventh Annual Message of President Grant, 1876, *U. S. Messages and Documents*, 1875–1876, p. 22.

[33] Keiler, p. 81.

[34] Dingley Report, p. 84.

[35] Saugstad Report, p. 58.

[36] 26 U.S. Stat. 830–832 (March 3, 1891).

[37] Farquhar Report, pp. 49–76.

[38] *Report on the Ocean Mail Steamship Services between the United States and China* (1866), Senate Report no. 116, 39 Cong., 1 Sess. pp. 3–4.

[39] 13 U.S. Stat. 430 (Feb. 17, 1865).

[40] Zeiss, p. 22.

[41] Lynch Report, pp. 274–275.

also operating six wooden paddle ships in its old service to Panama. It thus possessed almost complete control over the American steamship traffic in the Pacific. One other firm, the North Pacific Transportation Company, maintained services out of San Francisco, one to Mazatlan, Mexico, with two wooden steamers, one to Oregon and Puget Sound ports with four steamers, and one to Honolulu with one vessel, the *Idaho*, 1077 tons.[42] The Hawaiian service was established under the Act of 1867[43] to replace that formerly provided by the Pacific Mail Company, and involved a payment by the government of $75,000 annually under a ten-year contract. It was designed to attach the rising sugar economy of Hawaii closer to that of the United States. Both services were designed to prevent the extension of British contract services into the western Pacific. These contractors were, in fact, symbols of the American intention to organize the commerce of the Pacific about San Francisco as a hub.

The Pacific Mail service came to an unfortunate end, however, as had those of the 'fifties. Despite the protests of Californians, who objected to the rise of the Oriental immigrant trade,[44] and of the sailing-ship interests, the subsidy was doubled by the Act of 1872,[45] and, in return, a doubled service was required. The Peninsular & Oriental Company was then operating vessels to the Orient from Europe on a fortnightly schedule. So far the policy merely duplicated that of Britain, although traffic was lighter. It was provided that the vessels to be accepted for this service thereafter were to be of iron, American-built, and of at least 4000 tons. Great difficulty was experienced in building such vessels, however,[46] and it was only in 1874 that two 5300-ton ships, the *City of Pekin* and *City of Tokio*, were finished at John Roach's yard.[47] Meanwhile, the Company ran into difficulties. Internal graft,[48] corrupt lobbying, the waste of funds, extensive

[42] Lynch Report, pp. 274–275.

[43] 14 U.S. Stat. 543 (March 2, 1867).

[44] *Resolution of the Legislature of California Requesting Congress to Oppose Any Further Subsidy to the Pacific Mail Company* (1874), House Misc. Doc. no. 213, 43 Cong., 3 Sess.

[45] 17 U.S. Stat. 201 (June 1, 1872).

[46] *Report on the Pacific Mail Steamship Company* (1875), House Rep. no. 598, 43 Cong., 3 Sess.

[47] Saugstad Report, p. 58.

[48] *Report on the Pacific Mail Steamship Company*, House Rep. no. 598, 43 Cong., 3 Sess., p. 3.

propaganda for subsidies, and the use of Oriental crews all injured its prestige.[49] Consequently in 1875 the additional contract was abrogated,[50] although the concern's new vessels were then nearly finished. The usual tendency of American contractors to operate "on a shoestring" and to lobby for additional funds had again appeared, together with the usual results, it being found that between $565,000 and $900,000 was actually expended by the President of the Company, Alden B. Stockwell, for bribes and fees.[51] The first contract consequently was not renewed, but the Company managed to survive. Indeed, it succeeded in expanding, for in 1882 it was operating twenty steamships, most of them modern, but, of these, only two were in the Oriental service, most of the rest being employed in the protected trades from San Francisco to Panama and from New York to Colon.[52] The Company was unable, however, to pay dividends for many years. It did, however, receive a new subsidy in 1892. The Company was still operating ships in the trans-Pacific trade in 1914, although most of its vessels were in the Panama service.

This was clearly a case of an infant firm which succeeded in establishing itself with the aid of a subsidy. In endeavoring to establish a strong quasi-monopolistic contractor the American government was, indeed, merely following British practice. The establishment of at least one such American firm in the Pacific was probably desirable in any case as a measure for promoting the economic security of the Pacific coast. The experience of the American government with its contractors was almost uniformly unfortunate, however, and this indicates that the systems of award and control were bad. No foreign government encountered such difficulties, largely because the reliance of the foreign contractors on subsidies was less and closer working arrangements with government officials were secured. Probably only the establishment of regulation by a public utility commission of services, expenses, accounts, and finances, and of a permanent relationship between the state and the contractor could have cured the weaknesses of American technique. These measures were not to come,

[49] Zeiss, p. 24.
[50] 18 U.S. Stat., pt. III, p. 342 (March 3, 1875).
[51] *Report of the House Committee on Ways and Means on the China Mail Service* (1875), House Rep. no. 268, 43 Cong., 2 Sess., p. xviii.
[52] Statements of J. B. Houston, President, and E. Lauterbach, Counsel, Dingley Report, pp. 236–237.

however, until 1936. Thus the Pacific Mail Company contract may be said to have been a failure for the same reasons which wrecked all of the earlier American contract services.

With the exception of these two services, American steam shipping in the foreign carrying trades developed painfully. The Lynch Committee proposed in 1870 that general bounties be given to all vessels, both sail and steam, employed in both foreign and protected carrying trades, thus establishing a system similar to those later developed in France, Spain, Italy, and Japan, but this measure failed because of its cost.[53] Bounties to shipbuilders were also proposed. These bounties would have been very acceptable to the owners of square-riggers and steam tramps, who naturally opposed contract payments.[54] Nevertheless, a few American shipping lines slowly developed. By 1882 the New York and Cuba Mail Line had three steamers in the service to Havana, three in that to Santiago, and five in that to Vera Cruz.[55] Special concessions by the governments at Mexico and Cuba are said to have been responsible for its initial success. In 1890 this firm had nine vessels in these trades,[56] but much competition in the West Indies was encountered from the subsidized Spanish contract carrier, the Compañia Transatlantica. The vessels employed ranged from the 3496-ton *Orizaba*, *Yucatan*, and *Yumuri* to the 2232-ton *Cienfuegos*.[57] The Clyde Line was then also operating five steamers in the West Indian trade, which were maintained as a result of special concessions and contracts with the governments of Haiti and Santo Domingo.[58] The Red D Line of Messrs. Dallett, Bolton & Bliss was established in a similar manner in the Venezuelan trade.[59] Organizations which were not protected by special private or state contracts found it impossible to compete, however, against the foreign contractors and independent lines and against the tramps, which "swarmed like flies after honey."

Only the deep-sea sailing ships showed the flag widely in inter-

53 Zeiss, p. 19.

54 Codman, *The Injustice of Granting Subsidies to Steamship Companies* (1871), Harvard Coll. Lib. Pamphlet Coll.

55 Dingley Report, p. 110.

56 Statement of W. H. T. Hughes, Sec.-Treas., Farquhar Report, p. 26.

57 Farquhar Report, p. 39.

58 Statement of W. P. Clyde, senior member of W. P. Clyde & Co., Farquhar Report, p. 151.

59 Farquhar Report, p. 151.

national competition. Indeed, in 1890, the registered steam tonnage of the United States amounted to but 197,630 gross tons, whereas the registered sail tonnage amounted to 749,000 gross tons.[60] The enrolled and licensed steam tonnage on the ocean, lakes, and rivers, however, amounted to 1,661,457 gross tons. The British steam merchant fleet then amounted to 12,053,000 gross tons, the German to 2,417,000 gross tons, the French to 1,068,000 gross tons, and the Norwegian to 810,000 gross tons.[61] Lloyd's then listed the total American ocean-going steam fleet at 1,004,000 gross tons. Nevertheless despite the difficulties of the shipping industry, American enterprise was vigorously entering the foreign carrying trade, but under foreign flags. As we shall see, the fact that this was done indicated that the ownership of tonnage was profitable for some capitalists.

5

The United States government eventually found it desirable to make another move to establish American-flag services on routes which were deemed essential. This action, which came in 1891, was the result of a long political battle by the shipping and protectionist elements, in which Senator Blaine of Maine played a dominant role.[62] This battle was closely related to the rise of American naval power, the coming emergence of the United States as a first-rate economic power, and the growth of imperialism.

The final result was the presentation to Congress of the Frye-Farquhar bounty bill of 1890, already mentioned, which was designed to establish a system, similar to that of France, in which American-built and -owned tramp-shipping was to be assisted by means of a general bounty of thirty cents per gross ton for each 1000 miles sailed in the inward and outward carrying trades of the United States. Special contract carriers were also to be established. No provision for the free purchase of ships was, however, included, and this omission enormously increased the cost of the proposed aid. In designing the system of subsidies the Farquhar Committee was, in fact, greatly influenced by the experience of France.[63] The bounty portion of the law was eliminated, how-

[60] A.R.C.N., 1890, p. 324.
[61] A.R.C.N., 1901, p. 128. Figures from Lloyd's Register.
[62] Zeiss, pp. 32–33.
[63] Farquhar Report, pp. ix–xi.

ever, in the course of Congressional debate. Furthermore, when the measure was passed in 1891 as the Merchant Marine Act of that year,[64] the rate of pay, under short 5–10 year agreements, for the contract carriers was reduced by about a third. The schedule of pay divided steam vessels into four classes, and the subsidy started at $4 per mile of the outward voyage for 20-knot 8000-ton metal screw vessels, and declined to 66⅔ cents per mile for 12-knot 1500-ton metal or wooden craft. Under this law the first serious effort to develop a system of American contract lines was made.

The same errors which had been committed before were, however, again committed. No attempt was made to adjust the subsidy of each contractor properly to his particular needs, as was certainly desirable considering the variations in costs and in the severity of competition among the routes. In most foreign policies this adjustment was made. On some routes the rate of pay was more than adequate, and on others it was not particularly tempting. Furthermore, the system of competitive bidding in making awards was continued, although it had been shown to be weak. No provision for the regulation of expenses or operations was included. Furthermore, the requirement that vessels be built at home raised the amount of the subsidy required by a very considerable amount and thus increased the risk, which was already great because of the traditional instability of American policy. In short, the act scarcely recognized the complexities of the problem or the reasons for the success of foreign contract services.

The measure was not particularly effective, but it did strengthen a number of operators, notably the Red D Line and the New York and Cuba Mail Line, and caused the establishment of an important American-flag service, the American Line, in the North Atlantic liner trades. The Postmaster-General asked in 1891 for proposals covering fifty-three routes, but the maximum pay possible was not sufficiently attractive to induce shipowners to make bids for contracts on more than eleven of these routes.[65] The rates of pay were, indeed, not high in comparison with those prevailing in foreign services, and were hardly sufficient, as long as the registry law was maintained, to provide adequate support for lines directly competitive with foreign contract services. They were however sufficient to maintain several non-

[64] 26 U.S. Stat. 830–832 (March 3, 1891).

[65] Saugstad Report, p. 60.

competitive services radiating from American ports. The Pacific Mail Company received the first contracts, as might have been expected. It received a contract, effective February 1, 1892, for three of its services. For the operation of second- and third-class vessels, 16- and 14-knot speeds, respectively, from San Francisco to Hong Kong, it received $381,784 annually; for the operation of third- and fourth-class vessels, 14- and 12-knots, respectively, from San Francisco to Panama, $90,224 annually; and for the operation of third-class vessels from Colon to New York, $82,188 annually.[66] The Pacific Mail then possessed fifteen mail steamships. The Red D Line of Dallett, Bolton & Bliss also received $76,461 annually for a service in its third-class vessels, the *Caracas*, *Philadelphia*, and *Venezuela*, to La Guaira, Venezuela.[67] The New York and Cuba Mail Steamship Company received contracts for service in third-class vessels from New York to Havana for $73,424, and from New York to Tuxpan, Mexico, for $131,976. This firm in 1893 had seven qualified mail ships. The struggling Brazil Line also received contracts for services to Rio and Buenos Aires, but the firm was not able to carry out its agreement.[68] Thus the primary effect of the law was to strengthen certain existing carriers.

The most important result was the establishment of the American Line of the International Navigation Company as a direct consequence of the Act of 1891. American capitalists, who were beginning to make extensive investments of capital in foreign ships, had secured control of the famous British Inman Line, which, however, soon lost its British mail contract. In order to compete with the great contractors of France and Britain and the rising German lines, the new owners, the International Navigation Company, therefore petitioned Congress for American registers for its two greyhounds, the *City of New York* and *City of Paris*, in order to make them eligible for mail pay, and offered in return to build two similar vessels in the United States. These ships, the *St. Louis* and *St. Paul*, were built by William Cramp & Sons after the two British vessels were admitted to the register by special act of Congress[69] and a mail contract for $644,800 annually had been awarded. These new vessels were among the finest liners in the trade, and the service at first was very suc-

66 A.R.C.N., 1893, p. 21.

67 A.R.C.N., 1893, p. 21.

68 A.R.C.N., 1893, p. 21.

69 27 U.S. Stat. 27 (May 10, 1892).

cessful. No adequate provision for renewals and additions of the fleet were made, however, and the line gradually fell behind in competition. Indeed, this difficulty of providing for new vessels dogged American policy right along.

The law was, on the whole, only partially successful during the active shipping period from 1900 to 1914. The American Line continued to operate under contract until the World War. An additional contract was concluded with the American Mail Steamship Company for a service from Boston and Philadelphia to Jamaica, beginning in 1899, the Company providing four 2104-ton ships, the *Dewey*, *Farragut*, *Sampson*, and *Schley*.[70] The American-flag service to Sydney via Hawaii maintained by the Oceanic Line, which was controlled by the Spreckles sugar interests, received a contract in 1902, and built a trio of 6000-ton ships, the *Sierra*, *Sonoma*, and *Ventura*. A scattering number of new vessels were also provided for the Cuban and Venezuelan lines. But the developments were hardly satisfactory. The subsidies were probably responsible for maintaining two score or so ocean steamers in the foreign trade and in promoting the development of the few lines mentioned. The security of the overseas transportation system was thus somewhat enhanced, but American shipping was still inadequate in volume to meet any major crisis. The Brazil Line was allowed to collapse, and with its passing American-flag steam communications with South America south of Cape San Roque ceased. Furthermore, the technique employed was faulty. The instability in policy, the high cost of new ships, the greater security available to owners under foreign flags, and the lack of flexible effective regulation and supervision made impossible the development of an efficient coördinated system similar to those developing abroad.

A drive for larger subsidies, and in particular for general bounties, consequently developed, but failed to result in legislation. This drive came to a head in the Hanna–Payne bounty bill of 1889 and the Frye bounty bill of 1900, both of which failed of passage.[71] The Merchant Marine Commission likewise brought out a bounty bill in 1905, and proposed the establishment of additional contract lines and the strengthening of existing lines.[72] Neither the opponents nor advocates of a strong shipping policy appreciated that the two chief obstacles were the high costs of

[70] A.R.C.N., 1901, p. 335. [71] Zeiss, p. 39. [72] Zeiss, pp. 48–51.

American-built ships and the absence of a strong, stable policy administered in the public interest by a commission. Hence the policy from 1891 to 1914 was only a very limited success.

6

Despite the troubles of the American merchant marine, American capital flowed into the shipping business in considerable volume. This movement took the form of large-scale investment in foreign-flag ships and shipping lines. Starting on a large scale during the Civil War, this movement continued until, in 1901, the 672,000-gross-ton [73] American-controlled foreign-flag fleet nearly equaled in size the 880,000-gross-ton American-flag fleet in the foreign carrying trade. These foreign connections were developed by small individual shipowners seeking lower prices of ships, by large line operators seeking to retain their business, by capitalists seeking to employ large funds profitably, by railroad executives endeavoring to extend their influence into ocean trade, and by the rising industrial firms, such as the United Fruit Company. By means of long-term charters and the establishment of subsidiaries, such tonnage was, in fact, readily acquired or controlled. The famous Guion Line, which operated, among others, the British greyhounds *Alaska*, *Oregon*, and *Arizona*, was originally an American shipping firm, engaged in the packet business, and was one of the first lines to change its flag. By 1870, they had six iron screw steamers of about 3000 gross tons, which were controlled and commanded by Americans.[74] One and all, these owners sought foreign flags to secure lower-priced ships and somewhat lower operating costs. There is ample evidence, in fact, that by 1890 the profits in foreign shipping were sufficient to attract American capital in large volume.

One of the most important of the American organizations of this type was the International Mercantile Marine Company, a Morgan combine formed in 1902 for the purpose of bringing the Atlantic passenger business under its control. This was the most vigorous attempt of American capitalists to avoid the burdensome restrictions of the registry laws and to take advantage of the economy and security of combination.[75] The episode in a sense

[73] A.R.C.N., 1901, pp. 34, 306–309.
[74] Statement of J. S. Williams, member of the firm, Lynch Report, pp. 32–34.
[75] Murken, pp. 146–155.

indicated that the American capitalistic economy had begun to approach maturity and was in a position to raise large sums of capital, found great trusts and combines, and reach out for control of resources and instrumentalities overseas. J. P. Morgan & Company had, in fact, founded the huge United States Steel Corporation but one year previously. On April 26, 1901 the Morgan Combine, by purchasing 71,000 shares at high prices, secured control of the Leyland Line, one of the five largest British shipping companies, which owned 65 steamships totaling 321,000 gross tons [76] employed in the American, Canadian, Iberian, and Mediterranean trades out of London, Liverpool, and Antwerp. The Morgans resold to Mr. J. R. Ellerman, the Leyland president, the ships operating in the Iberian and Mediterranean trades, retaining 44 vessels of 277,000 gross tons, which were the best in the fleet and included the new 14-knot 10,400 gross-ton *Devonian* and *Winifredian*, and three new 12,000–13,000 gross-ton ships then under construction.[77] The amount paid for the preferred and common shares was in excess of $11,000,000.[78] The International Mercantile Marine Company subsequently purchased the famous White Star Line, paying partly in cash and partly in stock, the Dominion Line, which operated in the trade from Europe to Canada, the International Navigation Company, which operated the American Line ships and some additional vessels under the British and Belgian flags, and the Atlantic Transport Line, which controlled the National Line. A special and favorable agreement was also concluded with the famous Belfast shipbuilding firm of Harland & Wolff.[79]

At the end of 1902 the corporation controlled 136 ships of 1,034,884 gross tons.[80] Its fleet was thus the largest under private control in the world, and equaled the entire 1,105,000 gross tons of the French Merchant Marine. It controlled a third of the 3,200,000 gross tons of dry cargo vessels employed in the American transatlantic carrying trade.[81] Of its fleet 85 per cent was under the British flag, 12 per cent was under the American flag, and 3 per cent was under the Belgian flag.[82] This division was a matter of great uneasiness to the American government, to

[76] Murken, p. 165; A.R.C.N., 1901, p. 313.
[77] A.R.C.N., 1901, p. 313.
[78] Murken, p. 167.
[79] Murken, p. 174.
[80] A.R.C.N., 1902, p. 67.
[81] A.R.C.N., 1902, p. 68.
[82] Murken, p. 178.

which such a large-scale investment in foreign ships was distasteful, to the British government, which feared for its communications, which had been painfully built up, and to the German lines, which feared cutthroat competition. In 1902, however, a community of interest was established with the Hamburg–American Line and the North German Lloyd by which the German lines and the International Mercantile Marine agreed to exchange a portion of the dividends paid by each, thus giving each group an interest in the other's welfare.[83] Then in 1902 the two groups secured a majority of the stock of the Holland–American Line.[84] The capitalization of the International Mercantile Marine was excessive, however, and unwarranted prices had been paid for the properties, with the result that it never was a financial success. Nevertheless, the episode indicated that American capital was still available for shipping on a large scale. With a change in the registry laws and a moderate amount of financial assistance, the tonnage might have been brought under the American flag. The foreign-flag tonnage proved to be of little use to the country during the World War, and this fact suggests that this type of divided allegiance is not desirable.

The ownership of foreign-flag vessels was widespread. It was estimated that in 1894 American firms owned 64 foreign-flag iron and steel steamships totaling 197,108 gross tons, which figure exceeded the 175,363 gross tons of this type under the American flag.[85] Many other foreign craft were under charter. By 1901 this figure had risen to some 670,000 gross tons.[86] Besides the I.M.M. group, there were seven important owners, namely the Chesapeake & Ohio Railroad, W. R. Grace & Company, the United Fruit Company, the New York and Cuba Mail Line interests, John A. Donald, and the Anglo–American Oil Company.[87] The number of unaided American-flag steamers operating in foreign trade was, indeed, very small. Many of these vessels touched at foreign ports in the course of coastwise voyages.[88] It was evident, therefore, that American shipping firms and industrial enterprises requiring tonnage preferred to invest in foreign-flag shipping and to accept the political risks involved.

83 A.R.C.N., 1902, p. 68.
84 Murken, p. 206.
85 A.R.C.N., 1894, p. xvii.
86 A.R.C.N., 1901, p. 34.
87 A.R.C.N., 1901, pp. 307–309.
88 List of voyages of American steam vessels, A.R.C.N., 1901, pp. 334–341.

7

It must be concluded that the policy of the government with respect to foreign-trade shipping was not highly successful. By the close of the nineteenth century, the United States had become a relatively mature industrial country well able to provide capital in large volume for business enterprises both internal and external. American business leadership, furthermore, was vigorous and competent. Many interests, railroad, industrial, and commercial, were desirous of controlling their ocean communications. In these respects, therefore, conditions were favorable. The greatest obstacle, however, was the high cost of ships, which forced many such owners to seek foreign flags. The operating differential alone was not as serious and might have been overcome in some cases by securing economies of scale, strong commercial connections, or a moderate amount of permanent assistance. The strong position of foreign contract services and conference lines was also an obstacle to the rise of new operators. Furthermore, lack of confidence in the stability of policies was a restrictive force. American shipping activity in the foreign carrying trade was, therefore, probably less than was justified by the economic condition of the country.

The result of this policy was that the amount of the participation of American-flag vessels in the foreign carrying trades of the country, measured by value of cargoes carried, fell steadily to 36 per cent in 1870, 17 per cent in 1880, 13 per cent in 1890, and 9 per cent in 1900, and stood at 10 per cent in 1914.[89] In gross tonnage the amount of the participation likewise declined from 38 per cent in 1870 to 19 per cent in 1880, but subsequently rose to 22 per cent in 1900 and 26 per cent in 1914.[90] This situation exposed the country to unnecessary risk of interruption of service.

A sound policy would have been, first, to allow the free purchase of vessels, subsidizing domestic building to whatever degree was felt desirable; and second, to recognize that the contract services were public utilities requiring careful and constant planning, regulation, and support designed to husband their resources and secure satisfactory performance. Only at the end of the period, however, was an echo heard of the policy of government

[89] Mer. M. Stat., 1936, p. 92.

[90] Mer. M. Stat., pp. 93–94.

ownership, which was later to become important. Yet within four years the United States government was to be the largest shipowner in the world. The outbreak of the World War thus marked the end of an era of ship operation in the international carrying trades.

CHAPTER XVII

THE RISE OF THE PROTECTED COASTWISE MERCHANT MARINE: GREAT WOODEN SCHOONERS AND STEEL STEAMSHIPS

I

WHILE THE FEDERAL GOVERNMENT and the ship operators engaged in the foreign carrying trades were encountering difficulties, the shipping industry in the protected carrying trades of the United States rose steadily and rapidly. As the United States developed its highly organized economy, the volume of traffic moving on the routes protected by the navigation monopolies increased rapidly and provided ample scope for the employment of a large merchant marine. Indeed, the protected carrying trade of the United States rivaled the international coastwise carrying trade of Europe in importance. On the Atlantic seaboard a large business arose in the carriage of heavy bulk cargoes, such as coal, ice, lumber, bricks, building stone, steel, phosphates, ores, and oil, to market. In addition, a considerable amount of high-grade traffic was developed by the steamship operators. The intercoastal carrying trade also sprang into greater activity toward the end of the century when the steamships of the American–Hawaiian Steamship Company began to round Cape Horn in the wake of the Maine full-rigged ships. Lumber, sugar, and other heavy products began to move on this route in some volume, although the great age of the intercoastal traffic was not to begin until the Panama Canal was opened. The coastwise traffic of the Pacific slope also gave employment to many vessels. After the turn of the century, the carrying trade to the outlying sugar islands of Porto Rico and Hawaii was also brought within the scope of the monopoly by the Acts of 1898 and 1899.[1] Alaska had already been included by an Act of July 27, 1868.[2] Finally, the rapidly

[1] Saugstad Report, p. 74.
[2] Saugstad Report, p. 75.

rising coal, wheat, and ore traffic of the Great Lakes, which, by the turn of the century were connected with the sea by canals, provided employment for a vast fleet. There was, however, severe competition in the movement of export cargoes from Canadian ships and in the international Lake trade generally from small Norwegian freighters. The variety and scope of the employments offered within these protected trades were, therefore, sufficient to maintain a large and diverse fleet of vessels.

It is thus not surprising that the coastwise fleet increased rapidly in size. The amount of enrolled and licensed tonnage employed in this trade on the ocean, Great Lakes, rivers, and other waters, which is the best measure of the size of the fleet, increased from 2,960,633 gross tons in 1863 to 3,409,435 gross tons in 1890, and to 6,818,363 gross tons in 1914.[3] In the year 1863 this fleet exceeded in size that registered for foreign trade by 1,033,747 gross tons, or by 54 per cent. In 1914, however, since the amount of the registered tonnage was but 1,066,288 gross tons, which figure was less than that of 1863, the margin was 5,752,075 gross tons, or 541 per cent. Furthermore, many of the registered vessels engaged in the intercoastal or Panama traffic were also employed in the protected trades. It is, therefore, evident that the greater part of the investment of capital in American-flag vessels went into the provision of equipment for this business.

It must be recognized that the development of shipping in these carrying trades was to a large extent the result of positive protective measures just as was the more limited development in the foreign trades. The river-boats and small coasting craft were, it is true, protected by geographical conditions and by the risks encountered by small or unseaworthy foreign ships in crossing the ocean. But in the absence of protective laws British, Norwegian, Japanese vessels, and probably those of other flags, would certainly have swarmed into the short-voyage coastwise, intercoastal, protected offshore, and Great Lakes trades, and might even have appeared on the larger rivers. This they could not do, however, and therefore the levels of freight rates rose until American shipowners were able to secure fair rates of return on their investment. The monopoly was, therefore, equivalent to a 100 per cent protective duty.

[3] A.R.C.N., 1914, p. 188.

Ship operators in these trades operated under conditions basically at least as unfavorable as those engaged in the foreign trades. They were required continuously from 1789 to 1914 to employ high-priced American-built tonnage. They were forced to employ crews which were composed to a large extent of Americans, or of foreigners resident in the United States, and hence in general wages on coastwise vessels were higher than on American foreign-going ships. They did not, however, have to meet the competition of foreign contract services or to withstand the discriminatory and unfair practices of foreign-controlled pools, rings, and combines. On the other hand, they did encounter hostile railroad policies and definite discrimination in the making of railroad rates.

The high cost of the coastwise shipping service was definitely paid by the shippers, who in turn forced the burden either forward onto consumers or backward onto producers. In general, as for example in the coal, lumber, and building-materials trades, the burden was shifted forward. In those cases in which the demand was highly elastic, the high costs of service either prevented cargo from moving or caused it to move overland. The resulting burden, which eventually was widely spread, was probably equal to or greater than that imposed on the taxpayers on account of the subsidies.

The coastwise fleet was composed of a wide variety of vessels, many of which were created by the conditions peculiar to the United States. Because of the absence of contract services, except for those to Panama along the east and west coasts, line shipping activity played a smaller role than it did in the international carrying trades, in which government contractors were an important factor. Much of American coastwise shipping was therefore of the tramp type. This suggests the conclusion that, but for the contract carriers, line activity might have been less than it was in the international trades. The coastwise traffic was, however, more dispersed than that on the international routes, and this fact definitely worked against the lines. The important line operators employed iron and steel steamships mainly in services between the important cities on both coasts and in the intercoastal trades. Tramp shipping services, however, were paradoxically supplied to a large extent by wooden sailing schooners, which because of economic conditions in the

United States were cheaper to build and operate than metal freighters until toward the close of the period. It is to the development of these vessels that we first turn.

2

The development of the great schooner, which produced the revival of the building of wooden ships, was the last great achievement of the old shipbuilding industry. The revival of the wooden sailing ship was caused, first, by the expansion of bulk-cargo carrying trades of both coasts, which were particularly suited for the use of schooners; and, second, by the remarkable technical improvements which the shipbuilders carried through during the crucial period from 1870 to 1900. These innovations made the sailing ship the lowest-cost bulk-cargo carrier in the American merchant marine. The builders and owners of wooden ships also had an advantage because their shipyard labor was a low-paid non-competing group, and the prices of the steel used by the shipbuilders were at times artificially high. For these reasons, the cheap, multimasted fore-and-aft rigged sailing tramp ship became the most characteristic feature of American coastwise shipping.

These schooners were primarily employed in the bulk-cargo trades of both the Atlantic and Pacific coasts, for which their low operating expenses and flexibility well fitted them. In the carriage of such low-grade cargoes, which were frequently stored for long periods of time at both terminals, high speed was not essential, and hence the use of sailing ships was possible.

On the Atlantic seaboard the most important of these employments was the coal trade out of Norfolk, Newport News, Baltimore, Philadelphia, Perth Amboy, and New York. This business grew rapidly as a result of the rapid increase in the use of coal for the heating of houses and buildings in the North and the growing demand for coal resulting from the rise of the industry all along the seaboard and in the nearby overseas areas. Hence the coal schooners soon superseded the earlier ubiquitous little firewood schooners of the northeastern coast. Much of the business consisted of the hauling of anthracite coal from the mines of Pennsylvania for coal merchants. For instance, the receipts at Boston, perhaps the leading discharging port, in 1889 consisted of 1,637,000 tons of anthracite, compared with 915,000

tons of bituminous.[4] Much of the anthracite was reshipped by rail to interior points. The receipts of bituminous coal at industrial centers such as New Haven, Providence, and Fall River were also substantial, however. With the increase in the demands of the owners of steam-driven power plants, this movement of bituminous coal expanded rapidly. The installed horsepower in New England alone rose by over 50 per cent from 1,792,342 horsepower in 1889 to 2,715,121 horsepower in 1899. With the coming of the Industrial Revolution to the South, shipments of bituminous coal in that direction likewise increased. The total expansion of demand for seaborne coal resulting from these developments was sufficient to create a very great shipping and shipbuilding boom, beginning about 1885. For instance, at Boston, the leading discharging port in New England, the receipts of coal by sea rose from 516,665 tons in 1864 to 1,125,516 tons in 1874, to 2,197,864 tons in 1884, to 3,151,482 tons in 1894, and to 5,201,670 tons in 1909.[5] At Providence the receipts rose from 1,037,000 tons in 1886 to 1,899,633 tons in 1900. The coastwise coal trade had thus by 1890 become a fundamental element in the economy of the East.

At first this trade was carried in small two-masted schooners and brigs which entered all of the little ports of the coast. Soon, however, the efficiency of the fleet was increased by the appearance of larger, faster, and more economical craft. To the larger and deeper ports sailed the new three-, four-, five-, and six-masted schooners. Most of these loaded in the Chesapeake region and made flying voyages around Cape Cod or went to Narragansett Bay. Smaller two- and three-masted vessels reached the smaller ports all along the coast and discharged. Every town and industrial enterprise located on waters navigable by the small, shallow-draft schooners had its coal wharf. No other agency could compete with these schooners, for the barriers of the Hudson and the Berkshires prevented the movement of coal overland to New England. In 1905 Boston received the trifling amount of 77,024 tons in this way. Many of the other ports and docks reached did not even have rail connections. Steam vessels were not sufficiently efficient in the small sizes to rival the schooners, and their

[4] F. E. Saward, *The Coal Trade* (Annual), 1890, p. 70.

[5] *The Coal Trade*, various years. The figures were supplied by the Boston Chamber of Commerce. Unit: tons of 2240 lbs.

large overhead costs in port were a serious drain. Furthermore, they could not be easily warped into the places to which the schooners went. Only the barge appeared as a serious threat. For many years, therefore, the tall coal schooner was ubiquitous along the coast from Texas to Maine.

Another trade was that in ice, which was often carried southward by schooners both great and small. The first shipment of ice was perhaps that made by Frederick Tudor, who cut it in Saugus, Massachusetts, and shipped it in 1805 from Boston on his brig, the *Favorite*, to Martinique, where it was used to preserve food and medicines.[6] The business was soon extended to Havana and other West Indian ports and to Charleston in 1817, Savannah in 1818, and New Orleans in 1820.[7] Thereafter ice brigs were commonly seen along the coast. In 1833 a cargo of 200 tons of ice was even dispatched to Calcutta in a full-rigged ship. The business soon expanded to new areas, notably Maine, from which about 1826 the first cargo of Kennebec ice, valued at $700, was shipped to Baltimore in the brig *Orion*.[8] Soon a number of icehouses were built along the upper reaches of this river.[9] By 1840, several thousand tons were being shipped coastwise to ports from New York southward in brigs and schooners, which, however, rarely carried over 300 tons.[10] Occasionally a Maine cotton ship bound south from Bath, Wiscasset, or Bangor carried a big cargo to Charleston, New Orleans, or Mobile. As late as the season of 1848–49 the cut was still small, only 10,000 tons, or thirty shiploads being harvested on the Kennebec.

The big boom came after the Civil War, and particularly after 1875 as a result of the rising demand for refrigeration and the progress of urbanization, which caused the exhaustion of local supplies of ice in the metropolitan regions. The production of ice in Maine consequently increased from 10,000 tons in 1848 to 971,000 tons in 1881, and to 3,092,000 tons in 1890.[11] On the Kennebec alone 1,441,000 tons were cut in the last-named year, and forty-eight large icehouses lined the shore of the river from

[6] State Street Trust Company, Boston, *Old Shipping Days in Boston* (1918), p. 35.

[7] Marvin, p. 35.

[8] L. C. Ballard, "The Maine Ice Industry," M.B.I.L.S. (1891), pp. 161–162; Allen, *History of Dresden, Maine*, p. 760.

[9] Ballard, pp. 162–163.

[10] Ballard, pp. 162–163.

[11] Ballard, p. 165.

Augusta to Bath.[12] Ice shipments were also made from Portland, Belfast, Rockland, Wiscasset, Searsport, and the Penobscot River towns, and probably from other ports as well. Some ice even came down by rail from the interior ponds and lakes. The ice was stored in great icehouses during the winter, and on the opening of navigation great fleets of schooners assembled to load it. Schooners were very useful in this trade because of their shallow draft and low conductivity of heat. All sizes of schooners, even the great four-, five-, and six-masters of Crowell & Thurlow,[13] regularly loaded in this trade. Thus frozen cargoes came to be of great importance.

The lumber trade also gave employment to vast numbers of schooners of all sizes. The cutting of spruce and pine lumber was in progress on a vast scale on the Penobscot and the Passamaquoddy, and in eastern Maine generally, and led to the use of hundreds of small vessels, which loaded at the innumerable mills of this region, to carry it to the markets at Boston, New York, and other ports. Likewise, the rapid extension of lumbering operations in the hard-pine forests of the South led to the employment of many schooners, especially large ones, in the trade from the Carolinas to the Northeast. Furthermore, from Tampa and Jacksonville came schooner-loads of railroad ties. It was on the Pacific Coast, however, that the lumber trade reached its greatest proportions. Large sailing vessels — barkentines and great schooners — loaded huge cargoes at Seattle, Tacoma, Grays Harbor, and other lumber centers, for San Francisco and other ports. These vessels were closely rivaled by the small wooden steam schooners of the West Coast. Thus the carriage of lumber, which was extensively transported by sea, was an important feature of schooner operations.

The schooners also were employed to carry a great variety of low-grade cargoes. Since they were so numerous as to be almost ubiquitous, they were extensively chartered for all kinds of operations. Some carried sulphur from Texas to market. Others loaded sugar in Cuba, Haiti, the sugar islands, and Louisiana. Granite and stone were carried from seaside quarries to the centers of building activity. From Rockland sailed the dangerous

[12] Ballard, pp. 165, 170–173.

[13] An examination of the voyage books of Crowell & Thurlow, shipowners of Boston, showed that many of this famous firm's vessels engaged in this trade.

lime-laden windjammers. Steel mills sometimes employed these vessels to carry girders, piping, and other steel products. From Tampa sailed phosphate-laden craft. Gypsum, iron ore, hides, bricks, scrap iron, rails, and case oil were among the remaining cargoes which were commonly lifted. In fact all heavy cargoes, and especially those originating in or destined to out-of-the-way places close to navigable waters, were the business of the schooner owners.

The business of operating these vessels, like that of operating square-rigged vessels, was highly competitive. The schooners were owned by numbers of firms, all of which competed for business in the charter markets. Rarely were any of these vessels placed on the general cargo berth. Rather they were chartered to carry full cargoes to a designated port, and these agreements were made in more or less active markets. Consequently rates fluctuated in response to the state of demand and supply. A number of the schooners, especially the larger ones, were organized into fleets controlled by great firms of managing owners, such as Crowell & Thurlow of Boston, which promoted the vessels, sold the shares, employed the officers and crews, secured charters, directed operations, and remitted the income — all for a commission of about 5 per cent on the freight money. Some of these firms controlled as many as thirty or forty vessels at a time. Other fleets were owned more or less completely by large shipping houses, most of which specialized in schooners for the coastwise trades. A large number were owned, however, by their captains, or by individual investors, and were operated as independent units. Indeed, in the schooner fleet many of the forms of organization commonly found early in the nineteenth century were preserved until after the World War.

3

The great schooner was the last technical achievement of the builders of wooden sailing ships. Notable advances were made in model and rig, but particularly in the latter, which made the American great schooner the most weatherly and economical sailing vessel in the world. Notable as had been the packet ships, the California clippers, and the grain ships, they had all suffered from the disadvantage of requiring large crews, and in the age of steam power, this became a primary weakness. Indeed, judged by modern standards the rig of a full-rigged vessel seems ex-

traordinarily inefficient. The spars were heavy and awkward to handle; the sails set rather badly for sailing to windward; and the handling and trimming of the sails required many men. To set a main topsail required the handling of eleven different lines simultaneously.[14] Much heavy and dangerous work had to be done alow and aloft, and the complexity of the rig raised serious labor problems in the days of poorly-trained crews and "shanghaied" sailors.[15] Indeed the rig of a ship with single topsails consisted of 9 distinct mast pieces, 2 bowsprit pieces, 12 yards, 2 gaffs, 1 boom, 20 sails, 126 parts of standing rigging, which had to be kept set up and in good condition, 204 running ropes, 2900 pounds of chain gear in ties and sheets, 335 single blocks, 83 double blocks, 2 treble blocks, 112 deadeyes, 47 bullseyes, 22 hearts, and 180 belaying pins.[16] All of these parts and many others had to be kept in order and free from chafe — a task which required all of the art of the able seamen. The entire mechanism had to be ready for instant handling, and sailors had to be familiar with it on dark nights. Furthermore, the vast amount of gear aloft was a serious retarding influence when sailing to windward. Indeed, in heavy head weather square-rigged vessels might be held up for weeks, as often happened in the winter westerlies in the North Atlantic or off Cape Horn. There was thus ample room for improvement, and this occurred under the pressure of competition during the post-war period.

In contrast, the well-balanced rigs developed on the American off-shore schooners were comparatively simple. The masts were placed rather close together, and the sail area was well divided. The running gear for the principal sail on each mast was reduced to three major lines, which could be taken to a steam winch if desired. The rig was highly centralized and was so organized that it was unnecessary to handle a large number of lines simultaneously, whereas in the square-rigged craft the labor power was greatly decentralized aloft and on deck. Square-rigged vessels were unable to make any effective use of steam winches for this reason,[17] although all of the American schooners were soon

[14] Captain J. E. Cole, *A Criticism of the Present System of Rigging Ships* (1860), Harvard Coll. Pamphlet Coll., pp. 15–25.

[15] R. B. Forbes, "On a New Rig for Ships," *Trans. I.N.A.*, XVI (1875), 165–168.

[16] Cole, p. 28.

[17] Captain R. J. Dunstan, "Two Famous Bluenose Ships," *Yachting*, XVIII (July 1935), 53.

fitted with steam power to perform all of the heavy work. Men rarely had to go aloft except to furl or set the gaff topsails, which were light sails in schooners. Since in maneuvering the sails were largely self-controlling, the schooners could navigate the narrow waters of the coastal seaways with great celerity. In beating to windward they could easily outsail the fastest of the clippers, for their rigs enabled them to point higher into the wind, and they had a rig which was aerodynamically more efficient. Hence the schooner rig was a notable advance.

The achievement of the shipbuilders lay in the placing of this rig, which formerly had been used only in small vessels, on sailing ships of the largest size designed to sail in the oceanic trades. During the first part of the nineteenth century the rig had been used mainly on small vessels in which high speed to windward was desirable, such as privateers or slavers, in West India ships which faced the necessity of beating against head winds during a large part of their voyages, or on small coasters and fishermen, while for seagoing and coastwise vessels of 150 gross tons or more, the brig, bark, or ship rigs were definitely preferred. The size of the two-masted coasting schooners was greatly increased between 1850 and 1865, however, some, such as the *Oliver Ames*, being over 450 gross tons.[18] These vessels were, in fact, as large as many of the European and East Indian traders of 1815. These vessels were soon exceeded in size by the new three-masted schooners which began to appear in the shipyards of New England between 1865 and 1873. These were a distinct innovation in both model and rig. A few sharp, heavily-manned square-topsail three-masters had been built for privateering and for the British Navy prior to 1815,[19] and a few small experimental vessels, which did not exceed 200 tons, among them the *Pan Matanzas*, *Aurora*, *Fame*, *Richmond*, and *Magnolia*, had been built during the 'thirties and 'forties,[20] but none of these craft resembled the economical freighters of the later period. The first vessel of the latter type is said to have been the *American Eagle*,

[18] Marvin, p. 364. [19] Chapelle, *The Baltimore Clipper*, pp. 44–47.

[20] The *Pan Matanzas*, 153 tons, was built by Reuben Currier at Dover, N. H., in 1824; the *Aurora*, 147 tons, and *Fame*, 130 tons, by Nahum Hall at Ellsworth in 1831 and 1833, respectively, and the *Richmond*, 199 tons, by Raynes & Fernald at Portsmouth in 1843; the *Magnolia*, 83 tons, which was built at Blue Hill in 1833, was the first straight fore-and-aft three-master. See Forbes, *Ships of the Past*, pp. 151–152; Portsmouth Registers, 1843.

386 tons, which was built by Joseph Clark at Waldoboro in 1865,[21] but such craft were soon being laid down almost everywhere. For instance, David Clark built the first one constructed at Kennebunkport, the *Jefferson Borden*, 562 tons, in 1867.[22] By 1873, there were seven such craft building in this town, the largest being the *Mathilde Kranz*, 751 tons.[23] Most of these vessels ranged between 400 and 700 gross tons in size, but some were much larger, the biggest built being, perhaps, the *Bradford C. French*, 968 tons.[24] These vessels, which required only three to five hands before the mast if fitted with steam engines and had extremely simple and evenly divided sail plans, there being no square sails, soon proved to be money-makers, and a veritable boom in shipping and shipbuilding was consequently created.

The age of the great schooners, during which the new rig was placed in sailing ships of the largest size, began about 1880. These vessels were produced as a result of the strong demand for larger low-cost tramp ships in the coastwise trades, the pressure to secure economies in operation, and the success of the smaller schooners. The great schooners, which were fitted with powerful steam winches, were the cheapest carriers per cargo ton of any sailing vessel. It was found, in fact, that the expenses of building and manning increased much less than in proportion to the increase in size. The first of the four-masters was the *William L. White*, 996 tons, which was built at Bath in 1880.[25] She was soon followed from the ways by many larger and better four-masters, some of which reached 1700 gross tons in size by 1890. These vessels, which were fast, economical, and handy, soon became the leading freighters in those branches of the coastwise trade in which there was a substantial volume of traffic. In 1888, however, the construction of still larger five-masted schooners was begun, the first being the *Governor Ames*, 1788 tons, which was built by Leavitt Storer at Waldoboro in 1888.[26] These vessels were even more economical than the four-masters, and a large number were consequently soon laid down. Many of both the four- and five-masted schooners were soon organized into great fleets of ten to forty vessels, which were operated by the great

[21] Miller, p. 204.
[22] Bryant.
[23] Bryant.
[24] Marvin, p. 365.
[25] Hall Report, p. 94; Chapelle, *History of American Sailing Ships* (1935), p. 263.
[26] Marvin, p. 370; Miller, pp. 194, 207.

shipping houses which specialized in this business, among which Crowell & Thurlow, J. C. Crowley, J. S. Winslow, G. C. Deering, and William Palmer were prominent. These firms dominated the charter business in the coastwise trades, and frequently placed their fast-sailing schooners in foreign carrying trades in which American steam tramps were unable to compete. These great schooners, which in the five-masted class reached sizes of 2500 gross tons, were the equal in size of the grain ships and compared favorably in carrying capacity with the small ocean steam tramps.

The climax came with the building of the huge six-masted schooners in Maine between 1900 and 1910, which as a group were the largest wooden sailing ships ever built. The first of these, the celebrated flyer *George W. Wells*, 2970 tons and the giant *Eleanor A. Percy*, 3401 tons, were launched in 1900 by H. M. Bean at Camden and Percy & Small at Bath respectively.[27] The ensuing decade was an age of great schooners, which were led in size by the huge six-masters of the Palmer fleet, the *Prescott Palmer*, *Dorothy Palmer*, *Elizabeth Palmer*, *Jane Palmer*, and *Davis Palmer*, all of which ranged between 2800 and 3100 tons, and by such big Winslow ships as the *Edward B. Winslow*, 3242 tons.[28] Indeed, from 1901 to 1910 the average size of the three largest great schooners built each year ranged from 2383 tons to 3242 tons.[29] The largest of these vessels was the huge *Wyoming*, 3730 gross tons, which was constructed at Bath in 1910 and even exceeded the great Sewall shipentine *Roanoke* in size by over 200 tons.[30] This vessel measured 329 feet in length, 50 feet in beam, and 30 feet in depth. The limit in the size which could be safely and economically achieved was reached in these vessels. The building of larger schooners of steel was not profitable largely because of the high cost of the steel hull. One such vessel, the seven-masted *Thomas W. Lawson*, 5218 gross tons, was, in fact, built by the Fore River Ship & Engine Company at Quincy in 1902, but she was not a financial success during her short lifetime. The building of the great wooden schooners was indeed possible in the United States only because of the low

[27] "The Present Condition of Shipbuilding in Maine," M.B.I.L.S., 1900, pp. 51–52, 56–57.

[28] A.R.C.N., 1901–1910.

[29] A.R.C.N., 1901–1910. In the years 1906–1910 the statement covers the average of the two largest.

[30] A.R.C.N., 1910, p. 12.

costs of construction of such craft. By 1910, however, the star of these craft was beginning to set.

The great schooners were generally manned with from 25 to 55 per cent less men than square-rigged vessels of comparable size — a fact which accounted largely for their great economic advantage. The complement of each schooner depended somewhat, however, on the amount of mechanical equipment, the nature of the voyage, the quality of the seamen, and the size of the sail plan. Most great schooners sailed with less than one man for 200 tons, and some had but one man for 250 tons. For instance, we find that the *Maude Palmer*, 1745 tons and 38,000 square feet of sail area, required but nine men, the *Paul Palmer*, 2193 tons and 64,000 square feet but ten men, and the *Elizabeth Palmer*, 3065 tons and 72,000 square feet but twelve men.[32] The five- and six-masters often carried two sets of steam winches, and this fact accounts for the advantage of the larger craft. In contrast, the grain ships normally were manned with somewhat more than one man for 100 tons, although the sail plans of ships of the two types were generally of comparable size. The advantage of the schooners in this respect is clearly indicated in the accompanying table, in which vessels of approximately equal sizes are compared.

CREWS OF GREAT SCHOONERS AND SQUARE-RIGGED SHIPS [31]

Schooners			*Ships and Barks*		
Name	*Gross Tons*	*Crew*	*Name*	*Gross Tons*	*Crew*
Eleanor Percy	3401	15	Shenandoah	3406	33
Dorothy Palmer	2872	12	Susquehanna	2744	27
F. C. Henry	2421	12	A. G. Ropes	2460	27
Edward Cole	1791	8	A. J. Fuller	1848	21
Alice Coburn	1603	10	Berlin	1634	17
Margaret Thomas	1427	11	Agenor	1487	17
Medford	1351	9	Palmyra (bk)	1359	14
B. Pendleton	933	8	C. Winslow (bk)	943	12

The great schooners were also well adapted to their work in other respects. Because of their solidly laid floors, heavy bottoms, and light-weight rigs they could sail without ballast, and

[31] U. S. Department of Commerce, *Merchant Vessels of the United States* (various years); "The Manning of Vessels," A.R.C.N., 1904, Appendix D.

[32] Statement of W. D. Palmer, A.R.C.N., 1904, p. 130.

hence the time in port and expense were reduced. The lines of the hulls were easy because of their great length, the deadrise was small, and the bilges were hard, with the result that they were heavy, though fast carriers.[33] Some of the schooners were deep-draft vessels modeled much like the grain ships and intended for the off-shore trades, but many were of comparatively shallow draft and were designed to reach the ice, lumber, and other docks located in shallow waters. The latter vessels were fitted with large centerboards, similar to those which had been used in the small Hudson River and Sound schooners and sloops since about 1830. The use of wire standing rigging, and the small amount of running rigging, also reduced maintenance costs below those on full-rigged vessels. In comparison with steam vessels the overhead costs of these vessels were light, and the burden during idle time in port, which was considerable in the short-voyage trades, was hence comparatively small. Many were also fast, powerful vessels, especially when in fresh beam winds, when speeds reached as high as from 12 to 16 knots, and unlike square-rigged craft they rarely became wind-bound. Passages from Hampton Roads to eastern New England ports were usually made in from three to six days, and passages from Newport News to Boston with full-cargoes were made in as little as fifty-two hours.[34] Colliers normally made round trips from the coal ports in less than two weeks. The West Indies were on occasion but six days from Boston or New York.[35] These vessels were indeed kept on the move, sometimes making as many as twenty-four round voyages in the coal trade in a year, whereas early in the nineteenth century a round voyage from New England to Virginia had required a month or two. The schooner thus put the sailing ship back into competition.

It is little wonder, therefore, that the shipowners became enthusiastic. Owners on the West Coast pointed out that none of the sailing ships of foreign nations could compete with the schooners in the lumber trade.[36] On the East Coast, until about 1906, owners were contemptuous of the steam colliers. Many

[33] B. B. Crowninshield, "Wooden Sailing Ships," *Trans. S.N.A. & M.E.*, xv (1907), 196. The lines of the Crowell & Thurlow vessel *Margaret Haskell* are reproduced.

[34] Crowell & Thurlow, Boston, Voyage Books and Scrap Books (MS). The four-master *Jacob M. Haskell* made the voyage mentioned in 1902.

[35] Marvin, p. 371.

[36] R.M.M.C., II, 1016, 1045.

firms, in fact, sent great schooners out onto the world trade routes, and others, such as J. S. Winslow, began to replace ships and barks with three- and four-masted schooners about 1890.[37] The schooners were particularly efficient in the trade-wind belts of the Atlantic and Pacific, where strong beam or head winds were encountered. Hence they were sometimes found in the South American coffee and hide trades, on the routes to the West Coast of Africa, and in the West Indian sugar trade, and some even rounded Cape Horn to the copper and nitrate ports.[38] In the Pacific, wooden schooners were extensively employed in the lumber trade to the Orient and to Australia. The first China voyage made by these vessels from an eastern port is said to have been that of the four-master *Geraldine* in 1884. The rig of the schooners was not well adapted, however, for the Cape Horn trades, such as those in grain and wool, in which the ability to run in heavy weather was important, and hence they rarely loaded in these trades.[39] Indeed, on routes in which strong fair winds were encountered, square-rigged vessels were faster. Although many of the schooners did go overseas, the primary field of their employment was the coastwise trade.[40] Hence although they furnished much of the coastwise transportation they had little effect on the international position of the American shipping industry.

4

The demand for schooners led to a considerable revival in the industry of building wooden ships, especially in Maine, where a large part of the business was centered. Indeed, the output of schooner tonnage slowly increased until 1891, when a maximum production of 110,036 gross tons was recorded, after which decay began, but this did not develop rapidly until after 1905. Output of schooners in the yards of the Atlantic seaboard rose rapidly from 31,000 gross tons in 1869 to about 90,000 gross tons in 1874, largely as a result of the strong demand for three-masted schooners. During these years, which were depressing ones for

[37] Statement of J. S. Winslow, Farquhar Report, pp. 165–166.

[38] Farquhar Report, pp. 165–166; P. McC. Reed, p. 174.

[39] "Foreign Voyages of American Vessels," A.R.C.N., 1901, Appendix M, pp. 349–356.

[40] Statement of J. S. Winslow, Portland shipowner, Farquhar Report, pp. 165–167. Usually only schooners of 800 tons or more went overseas. Winslow & Co. then owned 50 sailing ships of which 10 were in the foreign trade.

the owners operating in the foreign trades, the output of schooners greatly exceeded that of ships, barks, and barkentines, the figures in 1872, for instance, being 40,000 gross tons and 16,000 gross tons, respectively. It was at this time that nearly all builders turned to the building of these vessels. From 1875 to 1879, however, the situation was reversed as a result of the boom in the grain trade and the excessive supply of tonnage in the coastwise business. The output of schooners in the eastern yards fell as low as 15,000 gross tons in 1877. The next year, 1878, was the beginning of the great crisis in shipping and shipbuilding and there was general depression in the building of vessels of all types.

About 1882, however, the demand for "four-masters" and more

SCHOONERS BUILT ON THE ATLANTIC AND GULF COASTS[41]

Fiscal Years	*Gross Tons*	*Fiscal Years*	*Gross Tons*
1870–74	279,380	1895–99	150,307
1875–79	137,914	1900–04	332,557
1880–84	268,895	1905–09	184,307
1885–89	143,085	1910–14	72,937
1890–94	287,639		

"three-masters" caused a substantial revival in the business of constructing wooden ships, 1883 being a particularly good year. Thereafter shipyard activity oscillated with the swings in the demand in the coastwise trades, high rates bringing a burst of new business and low rates slack times. The development of the "five-masters" appears to have had a stimulating influence on shipbuilding in the early 'nineties, and the appearance of the "six-masters" had a like effect during the early years of the twentieth century. Indeed, considering output by five-year periods, the peak was not reached until the years 1900–1904, during which 332,557 gross tons were built in the East. After 1905, however, the competition of barges and steam freighters seriously reduced the demand for these craft. The accompanying table shows how the building of these vessels progressed.

The result was that in the United States the industry of building wooden ships rivaled in some respects that of building iron ships until a late date. Beginning in 1901 it is possible to distinguish vessels of 1000 gross tons or more from the others in the statistics.

[41] R.C.N.T., 1870–1884; A.R.C.N., 1885–1914.

In the entire country during the five-year period 1901–1905 there were built 92 great schooners of this size or greater, totaling 169,307 gross tons, and of these probably at least 12 were six-masters and about 26 five-masters.[42] In contrast, but 46 coastwise ocean-going steel steamships of 1000 gross tons or more, totaling but 156,893 gross tons, were built.[43] The net tonnage of these vessels was considerably less, and their margin of speed over the schooners was probably not great. Thus in the off-shore coastwise trades the great schooners were at least of equal importance to the steamships. Probably a decade earlier they had been of greater importance. During the years 1906–1910, however, the situation changed, there being built but 16 great schooners totaling 37,451 gross tons, compared with 58 ocean-going coastwise steamships totaling 217,604 gross tons.[44] During the years 1911–1915, the output of great schooners fell still lower to 13 of 19,127 gross tons. The construction of these vessels prevented the building of sailing vessels from dying with the great grain ship. The total output of sailing vessels in the United States did, in fact, fall from 1,285,572 gross tons in the 'seventies to 757,123 gross tons in the 'eighties, but thereafter it declined very slowly, being 714,488 gross tons in the 'nineties, and 695,675 gross tons in the first decade of the new century. The coastwise sailing fleet continued, meanwhile, to expand slowly. It rose from 1,185,251 gross tons in 1874 to 1,527,700 gross tons in 1904, and in 1914 was about as large as in 1874. Meanwhile the registered sailing fleet, which was mainly square-rigged, declined until in 1914 its 229,569 gross tons were but 17 per cent of the size of the skysail-yard fleet of 1874. The wooden schooner thus occupied a foremost place in American maritime history after 1880.

These vessels were built under conditions of severe economic pressure. It was necessary to assemble the materials in the Maine, Massachusetts, and Connecticut yards from distant regions. The last stage of timber exhaustion had been reached in which supplies of ship timber of many kinds became scarce even in distant areas. The white oak for the frames, which amounted to as much as 600 tons in the case of large vessels, was difficult to obtain in the river valleys of Maine, in Virginia, except far in the interior, and in Michigan, Ohio, and other northern states. Shipbuilders, after the turn of the century showed considerable concern re-

[42] A.R.C.N., 1901–1905. [43] A.R.C.N., 1901–1905. [44] A.R.C.N., 1906–1910.

garding the future state of the supply.[45] Such vessels as the *George W. Wells*, which required 550 tons for her 101 frames, were difficult to supply.[46] Indeed, when the frame of the *Maude Palmer* was cut near the Bath shipyard in 1900, this was considered to be an unusual event.[47] Hence many substitute timbers, such as second-growth, under-sized oak, hackmatack, maple, spruce, and birch were used. Iron knees and hackmatack and spruce knees from Canada were widely employed. Much of the spruce, hackmatack, and hardwood was now obtained in Canada and in northern Maine, from the latter of which it was taken out by the St. John River and thence coastwise by coasting schooner to the seaports.[48] For planking, southern hard pine was generally used, but some fears of increases in the price of even this material were felt.[49] Many of these long hulls, in fact, were weak because of the use of small-sized timber and woods which were subject to rapid decay. It was said that some of the big coal schooners were kept afloat mainly with the aid of their powerful steam pumps.[50] Since the huge white pines necessary for the great masts of these ships could no longer be obtained in the eastern states or in Canada, it was necessary to obtain Oregon pine from the Pacific Northwest.[51] The great schooners had some of the largest masts ever placed in sailing ships, ranging in length from 100 to 125 feet and in diameter to as much as 36 inches. The six lower masts of the *Eleanor A. Percy*, for instance, were 123 feet long, and were surmounted by 62-foot topmasts, and the spars of the *George Wells* were 119 feet and 58 feet, respectively.[52] In contrast, the mainmast of the celebrated clipper *Flying Cloud* measured but 88 feet. Even the lighter pine and spruce spars were often obtained in New Brunswick. Thus the schooners were built of scarce materials which were often assembled from distant points. Some Maine schooners had scarcely a piece of local timber.

Labor was also under pressure. The crisis of the late 'seventies caused the dispersion of much of the skilled labor force, and few boys were taught the shipbuilding crafts. The result was that old and middle-aged men were left.[53] In some towns, it was

[45] Crowninshield, pp. 197–198.
[46] M.B.I.L.S., 1900, p. 57.
[47] M.B.I.L.S., 1900, pp. 46–49.
[48] M.B.I.L.S., 1900, p. 47.
[49] Crowninshield, pp. 195–197.
[50] Wasson & Colcord, p. 209.
[51] Hall Report, pp. 102, 247.
[52] M.B.I.L.S., 1900, pp. 48, 52, 57.
[53] M.B.I.L.S., 1889, pp. 79–80.

difficult to secure men to resume construction once building had ceased.[54] Workmen were obtained, however, at comparatively low wage rates from the declining shipbuilding towns of Canada, and these men soon came into conflict with the local laborers.[55] Much of this labor supply was transient, coming down for four to ten months under agreements to work on particular vessels. There was continual pressure on wage rates, work was irregular, and in some towns the "lumping system" was used, under which the workmen were paid off in the late spring in lump sums the size of which depended on the prices received for vessels.[56] Only in this way could builders sometimes be induced to lay down vessels. In many towns the men still worked from sunrise to sunset in winter, and from 7 A.M. to 6 P.M., or ten hours, in summer.[57] The Knights of Labor succeeded in organizing a union at Bath in the 'eighties, which temporarily forced up wages,[58] but it was soon broken by the employment of Canadians. It did, however, abolish the store-pay system in some cases and lifted wage rates somewhat, although they were still low in comparison with those prevailing on the Delaware.[59] The truth of the matter was, however, that the position of the wooden shipbuilders was too precarious, and the workmen of the seaboard towns were too much in need of employment, to enable such activity to be very successful. Only the low cost of construction enabled the wooden sailing ship to succeed.

The building of these schooners was undertaken by a new generation of shipbuilders, but the plants and processes remained substantially the same. The industry along the East Coast remained centered chiefly in Maine, not because timber was now especially cheap there, but because only here could skilled master carpenters and low-priced skilled laborers be found. The industry thus became a labor-localized business. The number of yards was much smaller than was formerly the case, however, and the average size was a little larger. Bath was the leading center, and here were located the plants of the New England Shipbuilding Company and the Kelley–Spear Company, each of which normally employed about 300 men, as well as Percy & Small, William

[54] M.B.I.L.S., 1889, p. 79.
[55] M.B.I.L.S., 1889, pp. 100–101.
[56] M.B.I.L.S., 1889, p. 83. Certain sums were allowed the men on account.
[57] M.B.I.L.S., 1889, pp. 100–101; 1890, p. 163.
[58] P. McC. Reed, p. 173.
[59] M.B.I.L.S., 1889, pp. 80–89; 1890, p. 163.

Rogers, and G. C. Deering; downstream at Phippsburg were the plants of C. V. Minott and F. S. Bowker. The New England Shipbuilding Company was said to have the best-fitted yard of its type in the world. From their ways and those of their predecessor, Goss, Sawyer & Packard, 224 vessels had passed by 1894.[60] George Welt of Waldoboro built six huge schooners of the Palmer fleet.[61] Cobb, Butler & Company at Rockland built many ships for Crowell & Thurlow, and other firms engaged in the coastwise trade. Other important yards were those of H. M. Bean at Camden, Washburn Brothers and Dunn & Elliot at Thomaston, and McKay & Dix at Bucksport. There were also yards at Boston and in Connecticut. The larger establishments built from two to six great schooners at once, but the smaller ones commonly did but one ship a year and employed from 25 to 30 men.[62] Many of these vessels were towed to Boston, Portland, or New York to be rigged and outfitted, for few towns could then complete a vessel.[63] After 1900 the number of yards rapidly declined. There were then in Maine but 20 yards building wooden merchant vessels, although there had been 41 in 1889, of which 14 employing 1000 men had been in the district of Bath.[64] By 1906 there were but three yards at Bath, and the construction of schooners was said to be unprofitable.[65] Most of the famous firms had built their last vessels: William Rogers in 1902; E. & A. Sewall in 1903; and the New England Shipbuilding Company in 1906. Construction also languished elsewhere, the last big wooden vessels coming off the ways, for example, at Kennebunkport and Newburyport in 1901, and at Boston in 1905. Thus in many of the old shipbuilding towns the business continued to be conducted much as formerly, although under pressure, until the time of the World War.

5

As might be expected, the industry of building wooden ships temporarily sprang up during the quarter century prior to the World War in the Pacific Northwest, where the last great stand

[60] P. McC. Reed, p. 175.

[61] Miller, pp. 194, 207.

[62] M.B.I.L.S., 1900, pp. 48–64.

[63] Much information regarding the building of schooners was kindly supplied by Abner Chick of Kennebunkport.

[64] M.B.I.L.S., 1889, p. 79; 1900, pp. 48–58.

[65] These were Percy & Sewall, Kelley–Spear Co., and G. C. Deering. See Owen, p. 307.

of virgin timber was centered. This is another example of the attractive power of timber supplies on the shipbuilding industry. The development of the industry here was held back, however, by the fact that the Douglas fir, the principal timber, was believed to be unsuitable for shipbuilding. This timber was available for keels, frames, and planking in large sizes and in lengths as great as 300 feet. It also made excellent masts. The traditional white oak was not available, however, and the Douglas fir was found to decay rapidly. Indeed, it was not until the 'seventies that it was discovered that Douglas fir was reasonably durable if cut in winter, seasoned, and salted, and that its use was sanctioned by the San Francisco underwriters.[66] Hence, although the building of small vessels had occurred occasionally, beginning as early as 1811,[67] it was not until the 'seventies that large wooden vessels were laid down. The first of these were probably the ship *Wildwood*, 1100 tons, built in 1871,[68] and the grain bark *Cassandra Adams*, built in 1876.[69] On the whole, however, output remained small. The output of sailing vessels did not reach 10,000 gross tons until 1882, and at times it was under 1000 tons.[70] Indeed, during the twenty-four years, 1860–1884, but 85,711 gross tons were built.[71] Most of these vessels were small barks and barkentines registering from 300 to 500 gross tons and small schooners. The costs of construction appear to have been as high or higher than those in New England, doubtless because of the difficulty of securing labor. The ships and small barks cost as a rule between $70 and $120 per ton, depending on the size, fastenings and metal, and outfit.[72] It thus was probably more satisfactory for owners to secure second-hand eastern-built oak ships.

After 1890, however, there was considerable construction of

[66] Hall Report, pp. 131, 248–249.

[67] E. W. Wright, ed., *Lewis & Dryden's Marine History of the Pacific Northwest* (1895), p. 11. The schooner *Dolly*, 30 tons, was launched at Astoria in 1811, her frame having been brought from the East in the ship *Tonquin*.

[68] I am indebted to John Lyman of the University of California at La Jolla for this information.

[69] Hall Report, p. 135.

[70] "Report on Port Charges, Shipbuilding," etc., by one Coolidge, Sec. of San Francisco Chamber of Commerce, 1885. I owe this information to Mr. Lyman.

[71] "Report on Port Charges, Shipbuilding," etc.

[72] C. T. Hopkins, *Shipbuilding on the Pacific Coast*, Board of Marine Underwriters, San Francisco, 1867. I am indebted to John Lyman for information regarding material in this pamphlet. The fir, iron & copper-fastened A–1 ship *Wildwood* cost $80,000 or $73 per ton. This was about the price of similar Maine ships.

barkentines and great schooners ranging from 800 to 1600 gross tons for the thriving coastwise and off-shore lumber trades.[73] Some of the eastern builders went west at this time to secure better timber resources. During the 'nineties the output of these yards consisted, among other vessels, of 48 four-masted schooners, 1 five-masted schooner, and 9 four-masted barkentines. During the next decade the numbers were, respectively, 73, 4, and 15.[74] Numbers of three-masted schooners and barkentines were also built. None of these four- or five-masted vessels were built between 1910 and 1915, however, and it was therefore in these years that the crisis came. None of these vessels exceeded 1700 tons in size, and hence they were hardly rivals of the big Maine ships. Indeed, most of them were under 1300 tons. This construction was centered chiefly in the Puget Sound ports of Seabeck, Everett, Port Discovery, Port Blakeley, Port Madison, Port Ludlow, and Ballard, on the seaboard at Grays Harbor, in the ports on the Columbia River, and at San Francisco.[75] The Pacific Northwest was thus the last home of the old shipbuilding industry.

The World War, which brought great prosperity to American shipowners, saw a temporary resurrection of the building of wooden ships. The great schooners began to go overseas to Europe, Africa, the Mediterranean and South America on a large scale again, and many made very large profits.[76] In 1917, 14 great schooners of 1000 tons or more, totaling 20,212 gross tons, were completed in the country. In 1917, output rose to 40 vessels of 58,099 tons and in 1919 to 33 vessels of 48,299 tons.[77] Much of this construction occurred on the West Coast, where alone sufficient timber supplies were available. Many of these vessels were large four- and five-masted schooners and barkentines, ranging between 1500 and 2700 gross tons in size. Indeed, no less than 125 carrying these rigs, many of which were auxiliaries, were built between 1916 and 1919 in the West.[78] Some of these were, however, less than 1000 tons. This period definitely marked the end

[73] F. W. Hibbs, "The Shipping and Shipbuilding of Puget Sound," *Trans. S.N.A. & M.E.*, XII (1904), 275.

[74] Information supplied by John Lyman.

[75] Statement of J. B. Montgomery, shipowner of Portland, Farquhar Report, pp. 170–171; Hall Report, pp. 131–135.

[76] Crowell & Thurlow, Boston, Voyage Books (MS).

[77] A.R.C.N., 1917, pp. 19–20; 1919, p. 29.

[78] Information supplied by John Lyman.

of the building of wooden sailing ships, for on the conclusion of peace freight rates became unremunerative.

6

The chief rival of the coastwise schooner was the tow of barges, which began to be frequently seen along the seaboard after about 1880. The development of this business was caused by the construction of powerful yet economical coastwise tugs and by the appearance of a supply of low-priced barges, many of which were old square-rigged ships or schooners. The tows first appeared in the Long Island Sound coal trade in the early 'seventies, some going as far east as Narragansett Bay, and by 1880 they were playing a large role.[79] In the western part of the Sound these tows consisted of as many as twenty square-ended scows lashed together, which could carry as much as 30,000 tons. These tows were not adapted to navigation in exposed waters, however, and hence beginning in the early 'nineties a new type of ship-shaped barge, measuring from 200 to 600 tons, began to appear. These vessels, in tows of from one to five, were hauled in line ahead by powerful tugs. Each barge was fitted with a stump schooner rig, which was used when the wind was fair, and carried a small crew. These tows could make fair speed, were sufficiently seaworthy for coastal waters, and were very economical. By the beginning of the twentieth century, therefore, these tows were operating out of the coal ports to points as far east as Bangor and as far south as New Orleans.

The barge tows had considerable advantages over the great schooners. The cost of upkeep and repairs, especially aloft, was much less. They could be manned with about a third of the number of men of schooners of equal size, and but one set of navigating officers was required for the entire tow. Shallow-draft barges could often be fully loaded at wharves having small depths of water, whereas the larger schooners frequently had to finish out in the stream. The costly tugs could be continuously employed, often arriving with one fleet and departing with another on the same day, and the overhead costs of the barges when in port were very light. Of great importance was the fact that the large corporations in the business, which sometimes owned as many as fifteen tugs and a hundred barges, could offer producers a regu-

[79] Hall Report, p. 112.

lar, scheduled service directly to their waterfronts, whereas the operations of the great schooners were more irregular and less well organized. None of the schooner operators offered regular scheduled sailings. Hence the barge operators were able to make substantial inroads into their business.

The crisis appears to have come soon after 1906. In the highly important coal trade from Hampton Roads to Boston and other eastern New England ports a rate level of $2.00 or more per ton of coal was apparently sufficient to yield handsome returns to the owners of the schooners. Indeed, Mr. Palmer boasted as late as 1907 that his fleet of sixteen great schooners was earning 22 per cent on its cost.[80] During the first five years of the new century, schooners in this trade, in fact, usually received from $1.75 to $2.00 per ton.[81] By 1910, largely because of barge competition, the rates had fallen, however, to between 60 cents and $1.00 per ton, depending on the state of the charter market.[82] At the latter levels schooner owners secured but little if any margin over direct costs, and the returns were hence unattractive to investors. In the lumber trade from the Carolinas to Philadelphia, schooner rates, which had been between $4.50 and $5.25 per 1000 feet, were cut by the barge operators by 1914 to as low as $2.40.[83] New steel shallow-draft barges, which were very inexpensive and handy, were then in use. These declines in rate levels and others soon forced the schooners into the off-shore trades, such as those to the West Indies, in which rates were therefore also depressed. It was thus primarily the barges which brought an end to the operation of sailing vessels.

7

It is significant that few tramp steamships were built and operated in the protected coastwise and off-shore carrying trades. This may be attributed to the fact that steel steamships were too costly to compete for such traffic with wooden vessels. This view is borne out by the fact that few steel schooners were built in the United States, and that these hulls were somewhat costly in

[80] W. D. Palmer, Discussion, *Trans. S.N.A. & M.E.*, xv (1907), 201–202.
[81] Crowell & Thurlow, Boston, Voyage Books, Schooner *Jacob M. Haskell*, and other vessels (MS).
[82] Crowell & Thurlow, Boston, Voyage Books (MS).
[83] *Hearings on Exempting Barges from Compulsory Pilotage* (1916), House Rep. no. 9678, 64 Cong., 1 Sess., p. 35.

comparison with those of wooden construction. Indeed, only three were built prior to 1914, the famous *Thomas W. Lawson*, the *William L. Douglas*, 3708 tons, and the *Kineo*, 2128 tons. The last named was the last vessel to be built by the Sewall yard, and it is notable that this famous firm did not find it worth while to build more steel schooners. The big *Lawson*, which was in a class by herself, cost her owners $250,000, or about $48 per gross ton, which was a low figure. But within the range of size of the wooden ships these latter craft were definitely cheaper. For instance, the *George W. Wells* cost about $125,000, or $42 per gross ton, of which about $75,000 represented expenditure on materials and $50,000 expenditure on labor.[84] It seems likely, however, that but for the registry laws and duties on imported steel the United States might have secured a fleet of more efficient steel schooners and steam freighters for the coastwise trade.

The American coastwise steamships were, therefore, with some exceptions, employed principally in line services and in the carriage of high-grade general cargo and passengers. Unlike the schooner business, the line business soon developed monopolistic features in the sense that rarely did more than one line develop to serve a given route, although several of the routes might be indirectly competitive. Indeed, it seems probable that the economies and economic position of each line enabled it to expand sufficiently to absorb all of the traffic. When this was impossible, a condition of duopoly soon caused combination, either by means of a merger or through the creation of a holding company. The general trend was, in fact, toward the creation of regional lines operating out of the chief ports, notably New York, Boston, and San Francisco, in much the same manner that regional contract and non-contract shipping empires were created in the international carrying trades. These coastwise services, most of which were not under government contract, did not, however, have the rigidity of the latter. These lines were in a position to control their rates, to some extent at any rate, because their business consisted largely of the movement of high-grade general cargo, much of it packaged, at relatively high speeds. In this business schooners rarely competed. It was very rare, in fact, that a schooner was placed on the berth to load cargo of this sort. Hence it was only in the carriage of such cargoes as sugar, hides, lumber, and cement,

[84] M.B.I.L.S., 1900, p. 57.

which were only taken as a last resort, that the steamship operators met the full force of competition from schooners and square-rigged ships.

The situation in respect to the operation of steamships along both coasts and in the intercoastal trade after the Civil War was much different from that which had prevailed in the coastwise trade fifty years earlier. Then the coastwise vessels had provided the major transportation service along the coast, and the business was highly competitive. After the war, however, although the steamship business itself became less competitive, the competition between the steamship lines and the railroads became severe, with the result that the development of the coastwise marine was retarded and many lines became controlled by railroads. Only the schooners, which specialized in the carriage of low-grade cargoes at low rates, escaped this competition, except on the fringes of the territory served by them. The entire situation in the steamship business became, however, very unstable. The railroads found it to their interest to cut rates on freight moving between seaport areas to very low levels so long as they secured some margin above direct costs. The steamship lines, the service of which now closely resembled that of the railroads, tended to follow suit. The problem of the interchange of traffic between rail and water carriers also became exceedingly complicated. Hence new conditions rose which were to make the coastwise shipping business distinctly different from what it had been in the era of small sailing vessels.

8

The steamship lines which developed within the navigation monopoly may be divided into five groups. First, there were several groups of services which were partially competitive among themselves engaged in the short-voyage trades from Maine to the Virginia Capes. These lines came into competition with the coastwise railroads of this area, particularly the New Haven. Operating out of Boston in 1914 was the Eastern Steamship Corporation, a combination of a number of earlier small lines, which then operated separate services from Boston to New York, Portland, Augusta, Bangor, St. John, N.B., and Yarmouth, N.S., and locally along the Maine coast in the Penobscot region.[85] This

[85] Huebner Report, pp. 378–379.

concern then controlled 29 steamships, mostly wooden, totaling 54,771 gross tons. The constituent lines had been established some years earlier and had passed through many vicissitudes. The New York line had been organized in 1865 by James Whitney and others as the Metropolitan Line, and had secured a number of iron screw vessels, both passenger and freight.[86] Direct competition developed in 1867, and was maintained sporadically by several lines. A substantial minority interest in the Eastern Steamship Corporation was owned in 1914 by the New Haven Railroad as a result of previous extensive investments in New England steamship lines, but it was stated that no direct control of the line was exercised by the railroad.[87] The two leading vessels of this line were the celebrated turbine Boston–New York liners *Harvard* and *Yale*, of 3700 gross tons. The Eastern was partially rivaled by the New England Navigation Company, a holding company controlled by the New Haven Railroad, which by 1914 had secured control of almost all of the formerly independent lines operating ports between Cape Cod and Baltimore. One of its principal subsidiaries was the New England Steamship Company, established in 1907, which in 1914 operated 31 vessels of 75,306 gross tons in separate services between New York and Bridgeport, New Haven, New London, Providence, Fall River, and New Bedford, and also in local services in southern New England.[88] These services were only indirectly competitive with those of the Eastern.

The New England Navigation Company also controlled the Merchants & Miners Transportation Company, which in 1914 had 26 steamships totaling 65,708 gross tons.[89] This company, which controlled the traffic out of Baltimore, had been established in 1854 [90] after considerable difficulty had been encountered in securing the necessary $200,000 for the capital.[91] In 1859 it obtained two iron side-wheel steamships of 1200 gross tons, the *S. R. Spaulding* and *Benjamin Deford*, from Harlan Hollingsworth. Indeed, almost all of the coastwise operators secured iron vessels before they were adopted by the oceanic lines. After the Civil War the line increased its capital and extended its fleet and services. In 1876 the line's operations were extended to the South

[86] Dayton, p. 255.
[87] Huebner Report, p. 379.
[88] Huebner Report, p. 374.
[89] Huebner Report, p. 374.
[90] Huebner Report, p. 375.
[91] Dayton, p. 316.

from Baltimore with the purchase of the Baltimore & Savannah Steamship Company.[92] In 1873 a service from Baltimore and Norfolk directly to Providence was added to that to Boston. For a time the Company had a mixed fleet of wooden and iron steamships ranging between 700 and about 1400 tons, but beginning in 1879 a new fleet of larger iron and steel vessels was slowly acquired, among which were the Cramp-built *Allegheny* and *Berkshire*, 2014 gross tons, in 1881, the *Chatham*, 2728 tons, in 1884, and the *Dorchester* and *Essex*, 2537 gross tons, in 1889.

After the Spanish War, during which some of its ships were taken up by the government, this operator purchased many vessels and built others, and hence by 1914 its fleet was one of the best on the Atlantic Coast. It then was operating services out of Baltimore to Providence in the North and to Savannah and Jacksonville in the South, and out of Philadelphia to Boston, to Providence and Fall River, and to Savannah and Jacksonville. Its capital was increased to $2,000,000 in 1903 and to $5,000,000 in 1907. In that year the stock was put in trust and the New Haven, through the New England Navigation Company, bought 50 per cent of the resulting trust certificates, and also itself bought 317 shares in order to give it an absolute majority.[93] The Merchants & Miners thus became, in effect, the New Haven's outlet to points in the Middle and Southern States. Throughout the period the Company was comparatively profitable.

The New Haven acquired a very large interest in the coastwise steam shipping of this area. In addition to the services mentioned it controlled in 1914 the local steam services of the Maine Central, the coal fleet of the New York, Ontario & Western Railroad, consisting of 45 vessels of 19,312 tons, and a barge line operating in southern New England waters. Indeed, only a few straggling independent services existed. In the line traffic from New York eastward, in 1914, the New Haven and its partially owned competitor, the Eastern, had 88 per cent of the gross tonnage.[94]

Second, there were several important lines operating from North Atlantic to South Atlantic and Gulf ports. These either became organized in large combines or fell into the hands of the railroads. By 1914 there was but one service on each of the important routes. The most important networks were those of the

[92] Dayton, p. 319.
[93] Huebner Report, p. 376.
[94] Huebner Report, p. 372.

railroad-controlled Morgan and Savannah Lines, and of the Atlantic, Gulf, and West Indies Steamship Company.

Charles Morgan, the founder of the Morgan Line, started his steam-packet service from New York to Charleston and Gulf ports in 1835, and soon became the leading steamship operator running vessels to the Gulf of Mexico.[95] He also became interested extensively in railroad and industrial development in the Gulf States. During his career, which ended in 1878, he built 31 ocean-going coastwise liners, most of which were of about 1500 gross tons. In 1884 the Southern Pacific Railroad, which began operating through trains from California to New Orleans in 1883, secured control of the Morgan Line, which gave it a controlled connection to points in the Northeast.[96] The Southern Pacific also secured in 1902 the competing Cromwell Line, operating between New Orleans and New York, thus giving it complete control of the trade. Subsequently during the 'eighties a large fleet of steel screw steamships was built, most of the vessels of which were between 3500 and 4500 gross tons in size, and steamed at between 14 and 15 knots. The Company's coastwise fleet at the beginning of 1913 amounted to 21 vessels totaling 94,536 gross tons. The Company then operated a service from New Orleans, which carried traffic originating chiefly in the Gulf States and Mississippi Valley, and a service thrice weekly from Galveston, which handled mainly through intercoastal traffic. It also operated a line from New Orleans to Havana.

The Savannah Line was established in 1872, succeeding several earlier lines, by interests affiliated with the Central Railroad of Georgia. It operated principally between Savannah and New York, and Savannah and Boston, carrying cotton northbound and manufactures southbound. A long list of iron "cities" was built for this fleet, which in 1914 consisted of nine vessels totaling 43,484 gross tons. The Central of Georgia eventually came under the control of the Illinois Central, which in turn was partially owned by the Union Pacific. This line soon obtained a secure position in this portion of the coastwise trade, and its ships, headed by the 5425-ton *City of St. Louis* and *City of Montgomery*, occupied a prominent place in the coastwise steam fleet.

The leading American operator in the carrying trade from New York to the South Atlantic States, the Gulf States, Porto Rico,

[95] Dayton, pp. 412–413.

[96] Huebner Report, p. 390.

Cuba, and Mexico in 1914, was the Atlantic, Gulf & West Indies Steamship Lines, a holding company which controlled a number of formerly independent lines. Combination was the rule in the coastwise liner trades, in fact, and this was the second large-scale amalgamation of the non-railroad lines to be attempted, a prior combination put together by C. W. Morse, the Consolidated Steamship Lines, having collapsed. The principal subsidiaries were the Clyde Steamship Company, a 99-per-cent-owned subsidiary, which by 1913 was operating 21 vessels totaling 55,049 gross tons in the coastwise trades, the Mallory Steamship Company, 98-per-cent-owned, which had 13 vessels totaling 46,609 gross tons employed in the coastwise trades, the New York and Cuba Mail Steamship Company, already mentioned, 99-per-cent-owned, which operated 17 vessels totaling 68,776 gross tons, and the New York and Porto Rico Steamship Company, 100-per-cent-owned, which had 13 vessels totaling 37,147 gross tons engaged in the protected carrying trade between Porto Rico and the mainland.[97] The Southern Steamship Company and the Texas City Steamship Company were subsequently acquired. In the case of the latter, this was made possible by a severe rate war. The combined lines, in 1913, had 72 steamships totaling 227,123 gross tons, and provided a network of high-grade services linking Galveston, Mobile, Tampa, Key West, Jacksonville, Havana, San Juan, Santiago, and Vera Cruz with New York, Philadelphia, Providence, and Boston. The A.G.W.I., through the Mallory Line, had a very definite understanding with the Morgan Line regarding rate schedules and rates,[98] and, in addition, it had four directors with the Eastern.

Most of the remaining small lines were by 1914 controlled by railroads. The Old Dominion Line, operating between Norfolk and New York, was a jointly owned property of five railroads. The Chesapeake Steamship Company, operating between Baltimore and Norfolk, was owned by the Southern Railway and the Atlantic Coast Line. Also running on the same route was the Baltimore Steam Packet Company, a Seaboard Air Line Subsidiary. There were a few independents both in the Atlantic and in the Gulf trades, but all were weak and had difficulty in securing traffic originating with the railroads.

[97] Huebner Report, p. 384.
[98] Huebner Report, pp. 390–391.

9

In the next two branches of the protected carrying trades, competition between rail and water carriers was particularly keen, largely because the water carriers were independent. These two branches were the intercoastal and Pacific Coast carrying trades, which together employed a substantial volume of tonnage.

The intercoastal carrying trade in the days of the gold rush had been extremely profitable, for the Cape Horn and Central American routes were the only ones by which cargoes could be moved economically. The navigation monopoly had consequently been highly protective. The completion of the subsidized Union Pacific Railroad on May 10, 1869, was, therefore, an event comparable in importance in the shipping world to the opening of the Suez Canal, for it provided a vigorous rival route. Those who were interested in the development of the shipping industry were particularly concerned. Abiel Abbot Low, the famous New York merchant and shipowner, remarked in 1869 that "all the subsidies which our government has ever given to all the steamship lines that we have ever had would not equal the damage inflicted on the single remaining line (the Pacific Mail) by the Pacific Railway."[99] While admitting the value of the railroad, the shipping interests could not forget that the government had subsidized it to the extent of granting 22,000,000 square miles of land, and had supplied $27,000,000 for the capital on a second mortgage, thus lowering the costs of the enterprise and its rate levels.[100] Indeed, the time was coming when a national policy covering the relations between competing land and water carriers was to be urgently needed.

The completion of the rail route was the signal for a bitter struggle between the rival agencies. The Pacific Mail, which during the four-year period, 1866–1869, had carried 79,264 passengers from Panama to San Francisco, carried but 16,988 persons during the ensuing four-year period — a decline of 79 per cent.[101] In the opposite direction, traffic fell from 43,333 persons to 20,078 persons, a drop of 54 per cent. By 1880, the Company's

[99] Lynch Report, p. 44.

[100] Eliot Jones, p. 59. These figures cover the combined Union Pacific and Central Pacific Lines.

[101] Statement of J. T. Hellen, Treasurer of the Pacific Mail Company, R.I.C., 1884, p. 56.

traffic had fallen to but 1862 persons westbound and 1535 eastbound. The value of the westbound shipments by the Panama route also fell from $50,000,000 in 1869 to $15,000,000 in 1870, $3,000,000 in 1873, and $800,000 in 1881.[102] The stock of the Pacific Mail already by the latter part of 1869 had fallen by over one half in value. The Cape Horn carrying trade was also adversely affected. This was a period of severe economic warfare between the rival agencies.

The line soon passed under railroad domination, which restricted its development. About 1878 a contract was made by the Pacific Mail with the Transcontinental Railway Pool, good for twenty years, under which the Company leased 1200 cargo tons of space monthly to the railroads for a fixed sum, which at first was $90,000 monthly but was later reduced, thus giving the railroads control over its rates.[103] It also secured for a fixed sum exclusive use of the Panama Railroad for the movement of cargo between New York and San Francisco. These contracts were canceled in 1893, but about this time the Southern Pacific secured much influence through common stockholdings, and in 1900 this control was made more solid by the purchase of a majority of the stock.[104] This arrangement precipitated a struggle with the Panama Railroad, which, on the withdrawal of the New York–Panama ships of the Pacific Mail in 1893 established its own line. This concern also twice tried to set up a rival service in the Pacific, and twice failed.[105] The efficiency of the service by way of Panama was reduced at this time. In 1904 the United States government purchased the stock of the Panama Railroad Company, and the steamship line on the Atlantic became the first of the American state-owned lines of the present day.[106] After 1878, the aim of the railroad control was definitely to reduce the traffic on the Pacific Mail Company's lines, and thus to force the water route into a minor position.

It was not until comparatively late that a steamship line was

[102] Statement of Joseph Nimmo, R.I.C., p. 55.

[103] Huebner Report, p. 360; "The Control of Water Carriers by Railroads and Shipping Consolidations," *Report of the U. S. Commissioner of Corporations on Transportations by Water in the United States* (1909–1913), pt. IV; E. R. Johnson, *Report of the Special U. S. Commissioner on Panama Canal Traffic and Tolls* (1912).

[104] Huebner Report, p. 360.

[105] Huebner Report, p. 360.

[106] M. E. Dimock, *Government-Operated Enterprises in the Panama Canal Zone* (1934), pp. 78–80.

established on the long sailing ship route to California by way of Cape Horn. This service was begun by the American–Hawaiian Steamship Company, which had been formed by interests formerly engaged in the building and operating of wooden full-rigged ships, on October 30, 1900, with the sailing from New York of the steamship *American*. These vessels sailed on the long route from Puget Sound to Hawaii, where sugar cargoes were obtained, and thence without stops to New York.[107] In 1907, however, the American–Hawaiian secured a better route across the Isthmus of Tehuantepec by means of the Tehuantepec National Railway Company, a Mexican government line operating between Puerto Mexico and Salina Cruz.[108] The Company by 1912 had 21 steamships totaling 136,753 gross tons, divided between the Atlantic and Pacific services. Except for its contracts with the Mexican railroad, it was independent of railroad control.

In 1914 the intercoastal traffic was thus carried over three important routes, in addition to that by Cape Horn, which once more was almost solely a sailing-vessel route, namely by the Southern Pacific–Morgan Line route, by the American–Hawaiian route, and by way of Panama. The Panama traffic in the Pacific was then handled by the Pacific Mail, the vessels of which called at Mazatlan, San Blas, Manzanillo, Acapulco, and Salina Cruz, and by the newly-established California–Atlantic Line consisting of 4 leased steamships. So strong was the control of the railroads, however, and so vigorous was their rate cutting, that of the traffic between Atlantic and Pacific Coast ports in 1911 about 90 per cent by volume went by rail eastbound, and 95 per cent westbound.[109] Of the steamship services, that of the independent American–Hawaiian secured much the largest part of the traffic. The rates of the American–Hawaiian were then significantly from 20 to 60 per cent below those of the rail carriers. The entire situation, in fact, was very much tangled, but it is evident that the rate-making principles sanctioned by the Interstate Commerce Commission, which permitted rate cutting at points of water competition, together with the financial controls exercised by the rail carriers, which enabled them to threaten independents with rate wars, sufficed to hold the development of the intercoastal services in check.

[107] R.M.M.C., II, 1069.
[108] Huebner Report, p. 357.
[109] Huebner Report, p. 359.

The coastwise steamship traffic of the Pacific Coast itself was relatively free from railroad domination, but it was comparatively light. The principal intercoastal lines, the Pacific Mail and the American–Hawaiian, carried cargo between West Coast ports, the former between San Francisco and southern ports, and the latter between San Francisco and northern ports. The largest of the purely coastal lines, the Pacific Coast Steamship Company, in 1913 had 14 ships of 32,681 gross tons. All of these lines were in severe competition with the railroads, the tariffs of which they generally undercut, but some had difficulty in securing railroad-originated traffic. Competition from homeward-bound lumber carriers was also at times severe. On the whole, however, the situation in this division was more competitive than in any other.

The fifth division of the protected steamship trades consisted of the lines to the off-shore possessions, Hawaii, Porto Rico, and Alaska. The Porto Rico Line, which served that island, has already been mentioned. In the Pacific the rising carrying trade to Hawaii likewise became an important preserve for American shipping, particularly since railroad competition was impossible. Four lines came to serve these islands, the American–Hawaiian, the services of which connected them with Puget Sound ports and New York via Mexico or Cape Horn, and the Matson, Pacific Mail, and Oceanic lines which ran to San Francisco. Of these, the most important was the Matson Line, which had been started in 1882 and had gradually developed with the sugar business.[110] By 1912 this line had six steamships totaling 29,311 gross tons, among which were some large passenger craft. The Spreckles sugar interests also ran a number of vessels in the trade, including the three ships employed in the Oceanic Line service to Australasia.[111] There were also a number of steam vessels employed in the carrying trade from Puget Sound to Alaska. The two important operators in this trade in 1913 were the Alaska Steamship Company, which operated 13 steamships totaling 28,319 gross tons, and the Pacific Coast Steamship Company, which possessed 14 steamships totaling 34,683 gross tons.[112] These two carriers at times had agreements regarding sailings and other matters, and

[110] "With Matson Down to Melbourne," *Fortune*, September, 1937.
[111] "With Matson Down to Melbourne," *Fortune*, September, 1937.
[112] Huebner Report, pp. 352–353.

furthermore exercised such control over the wharves and Alaskan river steamboat services that they forced out rivals. As time went on, these protected off-shore trades became the most secure and profitable ones among those frequented by the American merchant marine.

10

It may be concluded that after the Civil War conditions became unsatisfactory in the coastwise carrying trades. These had been made a navigation monopoly for American shipping in 1817 in order to prevent this branch of the American transportation system from falling into the hands of foreign shipping and becoming subject to the risks of disruption in time of war. There is ample reason to believe, however, that as long as wooden sailing vessels were the primary carriers, and more or less complete competition prevailed, the policy was not burdensome on commerce; although the coastwise shipping industry was in a strong position in relation to overland carriers. After the Civil War, however, the navigation monopoly became restrictive and burdensome, and the tactics pursued by railroad interests tended still further to restrict activity. The result was that the coastwise shipping system became comparatively inefficient, and the shipping industry failed to attain the strength and size which were justified by its natural advantages.

The monopoly, in fact, was the sole reason why the coastwise shipping industry was able to grow, and it provided the most important source of demand for commercial ships. There was some question, however, regarding the wisdom of maintaining the registry laws so far as owners in this trade were concerned, for the resulting high cost of ships greatly hampered traffic. The wooden coastwise schooners, though efficient, were by the end of the century an anachronism. The heavy coastwise traffic of Europe, in contrast, was then being carried mainly in steel steamships. Had such vessels been available to American owners at world prices, it is likely that shippers would have secured much lower rates and a better supply of vessels. The cost of the steam liners was also comparatively high, and resulted in the charging of rates sufficiently above comparable levels abroad to meet the difference. In some cases, these rates were high enough to discourage the movement of cargo or to force business onto the rail lines.

Indeed, the elasticity of demand was very great on many of the transcontinental routes, with the result that much business was not obtained which could have been secured at lower rate levels. It seems probable, therefore, that a more desirable policy would have been to allow the free purchase of ships for this business, and to subsidize, to whatever extent seemed desirable, the building of similar vessels in domestic shipyards. Such a policy would have greatly invigorated the industry, especially the tramping portion of it.

There was little debate, however, regarding the monopoly itself, which was generally accepted as part of the protected system. The shipowners and shipbuilders all favored its retention, and in this they were supported by the railroad interests, which feared the rivalry of foreign freighters most of all. It was also accepted by the government, which relied heavily on coastwise tonnage during the Civil and Spanish Wars. As a protected reservoir for tonnage the coastwise carrying trade was, in fact, of the utmost importance in the economy of national defense, and but for the monopoly policy the United States would have entered the World War very badly prepared to meet the major shipping problem which had to be faced. Indeed, there is ample evidence that the government was content to allow the monopoly — the burden of which was borne by the consumers and producers, and which was, therefore, a more convenient device than the subsidy to administer — to provide the shipping and shipbuilding capacity considered essential for the national defense. The navigation monopoly also had a considerable promotive effect, for it enabled many American lines to become established and to secure economies of large-scale operations. The test of removing protection was never made, and probably could not have been made without disaster to the shipping industry. It may be asked, however, if it would not have been more desirable to reduce the costs of service on domestic routes rather than on the foreign routes, particularly since it was the policy of the American government, as it was of every national government, to promote internal unification by promoting and subsidizing railroads, highways, and canals.

The same tendencies toward regional monopolies, understandings, and communities of interest which were observable in the foreign carrying trades also developed in the coastwise ones. Some arrangements for the rationalization of service appear to

have been necessary so far as the line operators were concerned. Economies of considerable importance could be secured through the coördination of sailings, the organization of routes so as not to involve unnecessary duplication of services, and the use of common terminal facilities. Indeed, on many routes the traffic was insufficient to support more than one high-grade line, so costly had suitable ships become. Where rivalry existed the threat of cutthroat competition or its occurrence soon produced agreements, or at least, a condition in which the rate leadership of the dominant carrier was followed. "Fighting ships" and other unfair devices were often employed against weak newcomers. It seems likely, therefore, that the existence of a considerable degree of monopoly power, either formal or informal, produced higher rates than were desirable in those cases in which tramp or rail competition were ineffective. The organization of the line steamship business was, in fact, fast approaching a stage in which some positive governmental control was necessary. The government might have applied the Sherman Act in order to free some of the services of monopolistic elements, and in fact did so partially in 1912,[113] but there is ample evidence that on many routes this would have disrupted operations seriously. Another solution, which had more merit, was to recognize that the steamship lines were quasi-public utilities, and to regulate their business practices accordingly.

The problem of establishing sound relations between the rail and ocean carriers was particularly complex. The control of some of the leading ocean carriers by railroads, which were interested in checking their development, was a particularly serious feature of the Civil War situation. The competitive slashing of rates at competitive points, the use of freight contracts giving favored rates to shippers using all-rail routes, and other unfair devices also severely checked coastwise shipping which strategically was in the weaker position.[114] Indeed, the ridiculously small proportion of the intercoastal traffic moving by water by 1914 was evidence of the effectiveness of these methods. The Interstate Commerce Act of 1887 [115] only extended the authority of the Interstate Commerce Commission to through rail and

[113] 37 U.S. Stat., pt. 1, p. 567.
[114] Kidd, 31.
[115] 24 U.S. Stat., 379.

water traffic under common control, and was of almost no regulating effect.[116] The Panama Canal Act of 1912,[117] however, made it unlawful for any railroad to own, lease, operate, control, or have any interest whatever in any vessels operating in the coastwise trade with which the railroad competed or might compete. The Panama Canal shipping had to be absolutely divorced from railroad control, but on other routes the Interstate Commerce Commission was given authority to allow a continuation of such relations if in its opinion such action was desirable and would not reduce competition.[118] This law became effective on July 1, 1914, on the eve of the World War, which brought to a close an era in the history of the American merchant marine. While this was undoubtedly a desirable move, it nevertheless did not solve the complicated problems of railroad competition and the interchange of traffic.

II

We have now completed our study of the American maritime industries and public policy down to 1914. That year, which brought the World War, saw the beginning of a new era in American maritime history in which government-owned shipping and far-reaching regulation were to be leading features. We have seen how the old individualistic competitive shipping industry evolved into one dominated by large-scale enterprise more or less monopolistic in nature and rigid in operation. A vestige of the old industry remained, however, in the schooner business. During the nineteenth century the economic and technical conditions in the shipbuilding industry also changed rapidly, and as they did so the initial advantages of the American shipbuilders and shipowners changed into serious disadvantages. New problems in navigation policy were hence created.

A quarter of a century after 1914 some of these problems were in the process of solution, but others remained unsolved. The shipping world today bears little resemblance to that of the period covered in this study, although many of the old contractors and independent lines still survive and have become apparently permanent and essential features of the world economy. Com-

[116] I. L. Sharfman, *The Interstate Commerce Commission* (1931), I, 106–107.
[117] 37 U.S. Stat., pt. 1, pp. 566–567 (Aug. 24, 1912).
[118] Sharfman, I, 107–108.

bination and organization have gone still further. Governmental support is widely given to shipping at home and abroad. Wooden ships and sailing vessels have almost entirely disappeared. The economic importance of shipping to rising militaristic and warring states has become greater, and navigation policy has become more political in nature.

Looking backward, it appears that the failure of the American government to develop a larger and more efficient shipping industry was short-sighted and, eventually, costly. The importance of the maritime industries in the economy of national defense is much more widely appreciated now, however, and there is evidence that the United States, like the powers of Europe in the nineteenth century, is determined to develop a substantial merchant marine in order to protect its communications from interruption and increase the effectiveness of its naval and military forces. The three-billion-dollar government shipbuilding program of the World War, which, together with other acquisitions, caused the American merchant fleet to rise from 6,500,000 gross tons in 1910 to 17,000,000 gross tons, thus taught a lesson which is not likely to be disregarded. Indeed, in all nations shipping policy has become more aggressive. Cost and demand conditions have become such that equilibria are no longer freely and simply determined. The trend since the establishment of the first contract services has been toward closer and closer relationships between shipping lines and governments and toward the development of great national organizations under governmental control.

In the United States the government has been engaged in trying to devise satisfactory techniques for the support and control of the maritime industry. For the first twenty years after 1918 the situation resembled that of the early nineteenth century, for the vast fleet of war-built ships provided a vast reservoir of tonnage which was sold at low prices, some of which ranged as low as $7.50 per gross ton. In an effort to build up the fleet and stimulate sales of government lines and ships the Merchant Marine Act of 1928 was passed. This law granted heavy mail pay and provided for the establishment of contract services on nearly all important trade routes. This measure failed, as had the subsidy measures of the nineteenth century, because of the high cost of ships, a failure to separate the shipping and shipbuilding problems, and the lack of control over operations, ex-

penditures, and accounts, which omission led to a waste of funds, inefficiency, and corruption.[119]

It was not until the Merchant Marine Act of 1936 that the implications of the changes in the maritime industries in the nineteenth century were fully recognized and a policy was adopted of establishing large regional contract services under a modified type of public utility regulation.[120] The shipbuilding problem, which again has become important, has been solved by means of a special subsidy, but no provision for the purchase abroad of additional ships has been made. Provided with vessels by the state at world price levels, American firms acting as owners or as charterers of government tonnage and aided by moderate operating subsidies, are building up comparatively strong positions in world trade. The government itself is appearing as a stockholder in some of these operating companies. In the future it appears likely that a group of strong contractors and charterers will arise, and that the American shipping system will consist of both privately owned and operated and state owned and chartered lines, all of which will be fully regulated. Thus the development of the industry from a free, competitive, individualistic type of organization toward a position as a major public utility is well advanced.

[119] *Hearings before the Special Committee on Ocean and Air Mail Contracts* (1934), 73 Cong., 2 Sess.

[120] J. G. B. Hutchins, "One Hundred and Fifty Years of American Navigation Policy," *Quarterly Journal of Economics*, vol. LIII (1939).

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  A. Congressional reports and documents on shipping and navigation policy
  B. Congressional reports and documents on steamship subsidies
  C. Other Congressional documents
  D. Hearings
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  F. Special reports by government agencies
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II. Official documents of Great Britain and Canada
  A. Parliamentary papers on shipping and navigation policy generally
  B. Parliamentary papers on subsidies and mail contracts
  C. Other British parliamentary papers and documents
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III. General works on economic history

IV. General works on the shipping and shipbuilding industries and their history

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VI. Navigation policy
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VII. Naval architecture and marine engineering
  A. The building of wooden ships — design, construction, methods, and history of naval architecture
  B. The building of iron and steel ships — naval architecture, marine engineering, and shipyard practice

VIII. The shipbuilding industry — history, organization, and economics
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IX. The shipping industry — history, organization, and economics
  A. Sailing ships
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